

# EXHIBIT B

1 UNITED STATES DISTRICT COURT

2 DISTRICT OF MINNESOTA

3 - - - - -

4 In Re:

5 Bair Hugger Forced Air Warming

6 Products Liability Litigation

7

8 This Document Relates To:

9 All Actions MDL No. 15-2666 (JNE/FLM)

10 - - - - -

11

12 DEPOSITION OF JOHN P. ABRAHAM, Ph.D.

13 VOLUME I, PAGES 1 - 396

14 JULY 20, 2017

15

16

17 (The following is the deposition of JOHN P.  
18 ABRAHAM, Ph.D., taken pursuant to Notice of Taking  
19 Deposition, via videotape, at the offices of Ciresi  
20 Conlin L.L.P., 225 South 6th Street, Suite 4600, in  
21 the City of Minneapolis, State of Minnesota,  
22 commencing at approximately 9:26 o'clock a.m., July  
23 20, 2017.)

24

25

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Nathan Bushnell

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	Mr. Goss	340

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3	11	Article, Stochastic modeling of atomizing spray in a complex swirl injector using large eddy simulation, Apte, et al, 2009
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5	13	Article, Forced-air warming and ultra-clean ventilation do not mix, McGovern, et al, The Journal of Bone & Joint Surgery, 2011
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1 P R O C E E D I N G S

09:26:46 2 (Witness sworn.)

3 JOHN P. ABRAHAM, Ph.D.,

4 Called as a witness, being first

5 duly sworn, was examined and

6 testified as follows:

7 EXAMINATION

8 BY MR. ASSAAD:

9 Q. Please state your name for the record.

10 A. John, J-O-H-N, Patrick, P-A-T-R-I-C-K,

11 Abraham, A-B-R-A-H-A-M.

12 Q. Have you ever had your deposition taken

13 before?

14 A. Yes.

15 Q. Approximately how many times?

16 A. Six or seven.

17 Q. Were they all in the capacity of an expert  
18 witness?

19 A. Yes.

20 Q. And we'll get to those in a little bit. I'm  
21 sure -- You've been through the drill before, but I  
22 have to go over a few instructions --

23 (Interruption by the reporter.)

24 Q. You've been through the drill before, but  
25 I'm going to go over a few instructions. Fair?

09:27:36 1 First of all, I'm going to ask you numerous  
09:27:38 2 questions today. If you don't understand the question  
09:27:40 3 I'm asking, please let me know and I'll do my best to  
09:27:43 4 rephrase it. Fair?

09:27:45 5 A. Yes.

09:27:45 6 Q. If you answer the question that I've asked,  
09:27:46 7 I will assume that you understood the question. Fair?

09:27:49 8 A. Yes.

09:27:51 9 Q. At any time you want to take a break just  
09:27:53 10 please let me know. I just ask that you request a  
09:27:55 11 break after you answer a pending question. Fair?

09:27:58 12 A. Yes.

09:28:00 13 Q. Okay. We've met before; correct?

09:28:01 14 A. Yes.

09:28:02 15 Q. We've actually met at the deposition of Dr.  
09:28:04 16 Elghobashi; correct?

09:28:05 17 A. That is correct.

09:28:06 18 Q. And actually we had a -- two brief  
09:28:13 19 discussions at the hotel that we both stayed at in  
09:28:15 20 Irvine, California.

09:28:16 21 A. That is correct.

09:28:17 22 Q. And you agree with me that none of the  
09:28:20 23 conversations that we've had had any -- anything to do  
09:28:20 24 with the substantive issues in this case.

09:28:22 25 A. I agree.

09:28:23 1 Q. In fact, you commented on my demeanor during  
09:28:26 2 the deposition; correct?  
09:28:27 3 A. That is correct.  
09:28:28 4 Q. And on my jacket that I'm actually wearing  
09:28:31 5 today; correct?  
09:28:32 6 A. That is correct.  
09:28:32 7 Q. And then we had a brief discussion about  
09:28:35 8 your work in global warming.  
09:28:37 9 A. That is correct.  
09:28:38 10 Q. Okay.  
09:28:39 11 MR. GOSS: Are you contributing to global  
09:28:41 12 warming?  
09:28:43 13 THE WITNESS: Yes. Right now.  
09:28:46 14 (Laughter.)  
09:28:46 15 Q. And -- And actually we talked about my  
09:28:49 16 appreciation for your work in the global warming area;  
09:28:51 17 correct?  
09:28:52 18 A. That is true.  
09:28:53 19 Q. Okay. And it's something you're passionate  
09:28:54 20 about.  
09:28:55 21 A. That is true.  
09:28:56 22 Q. And you publish frequently in the area of  
09:28:59 23 global warming or climate change.  
09:29:00 24 A. That is true.  
09:29:02 25 Q. In fact I was looking at your CV, and within

09:29:06 1 the first -- I only looked at the first 40  
09:29:08 2 publications, and about 25 percent of those are on the  
09:29:10 3 issue of global warming or climate change.  
09:29:13 4 A. That sounds reasonable.  
09:29:17 5 Q. You give talks and presentations with  
09:29:20 6 respect to climate change and global warming.  
09:29:22 7 A. That is true.  
09:29:24 8 Q. And you even have some high-profile debates  
09:29:27 9 I've heard online regarding these issues.  
09:29:29 10 A. Correct.  
09:29:33 11 Q. And my understanding is the reason why you  
09:29:36 12 are passionate is because of the impact that global  
09:29:40 13 warming or climate change could have on the future of  
09:29:43 14 our -- of our world.  
09:29:45 15 A. That is true.  
09:29:46 16 Q. Okay. And you want to do whatever you can  
09:29:49 17 make the world a better place for -- for you and for  
09:29:53 18 your family and for the rest of the people in the  
09:29:54 19 world.  
09:29:55 20 A. Yes.  
09:29:58 21 Q. However, I think we could agree, based on  
09:30:00 22 the recent events in our country, that some people are  
09:30:05 23 in disagreement in the scientific community over  
09:30:07 24 whether climate change even exists.  
09:30:10 25 A. There is a very small minority of people in

09:30:15 1 the scientific community --

09:30:17 2 Actually I don't know of anyone who would

09:30:21 3 disagree that climate change exists. Sitting here now

09:30:25 4 I cannot think of a single person in the scientific

09:30:28 5 community who doubts climate change.

09:30:30 6 Q. But there's some high political figures that

09:30:32 7 disagree that climate change exists.

09:30:36 8 A. I mean, we have to be a little bit careful

09:30:39 9 because I don't think any political figures disagree

09:30:42 10 climate change exists. I think there are some people

09:30:45 11 who disagree that humans are causing current climate

09:30:50 12 change, or that humans are a significant cause of

09:30:53 13 current climate change, but I don't know of anyone who

09:30:56 14 would say climate change doesn't exist.

09:30:58 15 Q. Okay. I think that makes sense.

09:31:02 16 I guess the better question is some people

09:31:04 17 in the -- in the community believe that people don't

09:31:09 18 have a -- a significant impact on climate change.

09:31:13 19 A. Yes.

09:31:14 20 Q. Okay. Would that include people in the

09:31:17 21 scientific community as well, even though it's a very

09:31:20 22 few minority?

09:31:23 23 A. There is a small minority that thinks --

09:31:28 24 I mean, this is a difficult question and I'm

09:31:29 25 going to work to give you the best answer possible.

1 There's a very small minority of people in the  
2 scientific community who think that while climate  
3 change may exist and it's due in part to humans, it  
4 isn't going to be bad; or that the solutions may be  
5 more costly than the problem. So some of the most  
6 high-profile contrarians of the mainstream view  
7 acknowledge humans' affect on climate change, but it's  
8 an issue of magnitude and severity.

9 Q. Okay. And I take it that you disagree with  
10 respect to the people that the solutions would be more  
11 costly than the problem.

12 A. I'm not an economist, I'm a climate  
13 scientist. My understanding of climate change  
14 economics, through reading the literature, tells me  
15 that the most reputable climate-change economists are  
16 reporting that there will be social and economic costs  
17 with respect to future climate change, those costs  
18 will get worse as climate change gets worse, and in  
19 many cases the solutions are less expensive than the  
20 costs.

21 Q. Okay. In any event, given the potential  
22 impact of climate change, it is important to pursue  
23 good science.

24 A. I agree.

25 Q. And to pursue good science you want a solid

09:33:16 1 methodology.

09:33:18 2 A. Can you define what you mean by  
09:33:20 3 "methodology"?

09:33:22 4 Q. Let me ask you this. I assume in your  
09:33:27 5 research you use methodology to pursue answers to  
09:33:31 6 problems.

09:33:32 7 A. Yes.

09:33:33 8 Q. So how would you define "methodology"?

09:33:37 9 A. I would define methodology as -- as your  
09:33:41 10 plan.

09:33:46 11 Q. And to pursue good science you would need a  
09:33:48 12 good plan.

09:33:50 13 A. I would agree.

09:33:52 14 Q. Okay. And in reviewing a -- a methodology,  
09:34:08 15 a methodology or plan should be repeatable; correct?  
09:34:14 16 That's why you have a methodology.

09:34:17 17 A. I would say the results should be  
09:34:20 18 reproducible.

09:34:21 19 Q. Okay. So if you have a good methodology the  
09:34:26 20 results should be reproducible.

09:34:31 21 A. I want to be careful about not conflating  
09:34:34 22 those two things. I mean, you can reproduce results  
09:34:37 23 using a different methodology. The key is are the  
09:34:43 24 results reproducible.

09:34:44 25 Q. Okay. So my understanding is you could have

09:34:48 1 a different methodology but obtain repeatable results.

09:34:57 2 A. Yes.

09:34:58 3 Q. Okay. But -- But the --

09:35:05 4 But whichever methodology you use, the

09:35:07 5 methodology has to be reasonable.

09:35:30 6 A. I would agree the methodology has to be

09:35:33 7 reasonable.

09:35:40 8 Q. And with respect to methodology there might

09:35:46 9 be multiple methodologies, but they should be

09:35:49 10 identified so someone in the community could determine

09:35:53 11 whether or not there's any potential biases in the

09:35:55 12 methodology.

09:35:57 13 A. Yes.

09:36:08 14 Q. And with respect to methodology, one of the

09:36:10 15 key is is that you need to communicate any assumptions

09:36:13 16 you make in the methodology.

09:36:17 17 A. You need to communicate assumptions that are

09:36:19 18 relevant that you expect could affect the results.

09:36:22 19 Q. Okay. And you would identify those in the

09:36:25 20 methodology.

09:36:32 21 A. I mean, it depends on how broad you're

09:36:36 22 interpreting the term "methodology." If your

09:36:39 23 methodology, for example, is a test plan or a

09:36:43 24 simulation method --

09:36:48 25 Could you restate your question?

09:36:49 1 Q. Well you've written many scientific papers;  
09:36:51 2 correct?  
09:36:52 3 A. Correct.  
09:36:52 4 Q. And usually there's a method -- a methods  
09:36:56 5 section in the paper; correct?  
09:36:57 6 A. A methods or an equivalent of a methods  
09:36:59 7 section.  
09:36:59 8 Q. Yes. There's some -- There's some section  
09:37:00 9 that says what you did and how you did it.  
09:37:03 10 A. Yes.  
09:37:04 11 Q. Okay. And the reason why that's there is  
09:37:06 12 for someone else that's reviewing the paper, it's  
09:37:09 13 there to understand the methodology that you used in  
09:37:13 14 performing your research.  
09:37:14 15 A. Correct.  
09:37:15 16 Q. Okay. And to determine whether or not the  
09:37:17 17 methodology you used is in fact correct?  
09:37:20 18 A. Yes.  
09:37:21 19 Q. Whether it is reasonable?  
09:37:23 20 A. Yes.  
09:37:23 21 Q. Whether it is a methodology used and well  
09:37:28 22 respected in the scientific community.  
09:37:29 23 A. Yes.  
09:37:30 24 Q. Okay. And in fact you've written papers on  
09:37:50 25 biases and errors with respect to issues in research.

09:37:58 1 A. Yes.

09:38:13 2 Q. And in fact you wrote an article in the  
09:38:15 3 Bulletin of the American Meteorological Society titled  
09:38:20 4 *XBT science: Assessment of XBT biases and errors.*

09:38:26 5 A. I -- I wrote an article --

09:38:28 6 The title sounds correct.

09:38:30 7 Q. Uh-huh.

09:38:30 8 A. I'm assuming you read it correctly, but yes,  
09:38:33 9 I wrote an article that is either that exact title or  
09:38:37 10 something similar.

09:38:38 11 Q. And it's important to communicate all your  
09:38:40 12 assumptions in your methodology because until research  
09:38:49 13 -- Strike that.

09:38:50 14 You mentioned you make -- you have to  
09:39:03 15 identify assumptions that may affect the results of  
09:39:07 16 your research; correct?

09:39:08 17 A. Correct.

09:39:09 18 Q. Okay. And it's important to communicate all  
09:39:11 19 -- it's important to communicate all your assumptions,  
09:39:14 20 because until research is -- the research is complete,  
09:39:16 21 you may not know whether the assumptions you make --  
09:39:19 22 you made impact the outcome.

09:39:22 23 A. I disagree.

09:39:24 24 Q. Why?

09:39:26 25 A. Because some assumptions you make are so

09:39:29 1 trivial you know they would not affect the results.

09:39:35 2 So I would -- I would amend your question, change your

09:39:39 3 question to not use the word "all" assumptions, but I

09:39:43 4 would say the important assumptions.

09:39:45 5 Q. Okay. So --

09:39:47 6 But you want to identify them and

09:39:50 7 communicate them in the methodology because for the

09:39:53 8 important assumptions, until the research is complete

09:39:58 9 you may not know whether those important assumptions

09:40:01 10 you made impact the outcome.

09:40:03 11 A. Correct.

09:40:04 12 Q. Okay. And you agree with me that in any

09:40:11 13 type of research you do that you want to gather as

09:40:13 14 much information as possible regarding research that

09:40:18 15 has been done in the scientific community.

09:40:23 16 A. I don't necessarily agree with that, and I

09:40:28 17 can explain. You gather as much background

09:40:34 18 information as you need to understand what people have

09:40:38 19 done and what the current state of the art is and the

09:40:43 20 current state of the knowledge is. Let's say that I'm

09:40:46 21 doing a paper on XBT biases, which is the title of the

09:40:51 22 paper you read.

09:40:53 23 Q. I think I understand your answer, though. I

09:40:55 24 mean, I don't need an example. I think I understand

09:40:57 25 what you're saying.

09:40:58 1 A. But -- But if I give one it'll be clear for  
09:41:01 2 the record.

09:41:01 3 Q. I get it though, I don't need -- I'm fine.

09:41:04 4 A. Okay.

09:41:05 5 Q. So with respect to determining whether or

09:41:20 6 not a -- an important assumption is correct or not,

09:41:24 7 how do you determine that?

09:41:32 8 A. Well you may look at someone else -- There's  
09:41:36 9 a number of ways.

09:41:37 10 For example, you may find someone who has  
09:41:40 11 done work in the past and they've articulated or shown  
09:41:43 12 that a certain assumption matters or doesn't matter.

09:41:46 13 Maybe you've done work in the past and you've  
09:41:48 14 quantified the effect of an assumption. Maybe the

09:41:52 15 assumption is obvious on its face. So there's a

09:41:58 16 number of ways where you might identify that an  
09:42:01 17 assumption matters or doesn't matter.

09:42:03 18 Q. Umm-hmm. Well you agree with me that  
09:42:10 19 certain assumptions can significantly affect the  
09:42:13 20 results.

09:42:14 21 A. I agree.

09:42:23 22 Q. Now I forgot to give you this instruction,  
09:42:25 23 but I'm going to ask you many questions today. I  
09:42:29 24 don't -- Unless I ask you to guess or give an  
09:42:31 25 approximation, when it comes to your expert opinions I

09:42:36 1 would not like any guessing, I'd like your -- your  
09:42:39 2 opinions without guessing. Fair enough?

09:42:41 3 A. Fair.

09:42:42 4 Q. And I don't think anyone here wants any  
09:42:44 5 guessing. But I might ask you to guess like guess how  
09:42:47 6 many hours you spent on something, that might be a  
09:42:49 7 guess. But when it comes to your expert opinions we  
09:42:52 8 don't want any guessing. Fair enough?

09:42:53 9 A. Fair.

09:42:54 10 MR. GOSS: I think we would -- rather than  
09:42:56 11 use the word "guess," I think approximation is the  
09:42:58 12 better term to use.

09:42:59 13 A. So if I could ask for a clarification.

09:43:01 14 Are you also asking me not to approximate,  
09:43:04 15 or are you just asking me not to guess?

09:43:07 16 MR. GOSS: He'll let -- He'll let --

09:43:07 17 Q. If the approx -- That's why --

09:43:09 18 If the approximation isn't something you can  
09:43:10 19 give as an expert opinion, for example, if I ask you a  
09:43:15 20 temperature in this room, you know, you might say well  
09:43:18 21 it's approximately between, you know, 70 and 75, you  
09:43:21 22 know, that's within -- within your education, training  
09:43:24 23 and expertise and just your experience. But to make  
09:43:28 24 an outlying guess about something when you don't know  
09:43:30 25 the answer, just say you don't know the answer.

09:43:32 1 A. Thank you.

09:43:33 2 Q. Okay?

09:43:33 3 You said you had six other depositions as an

09:43:40 4 expert witness; correct?

09:43:41 5 A. Incorrect. I think I said I had six or

09:43:43 6 seven.

09:43:44 7 Q. Six or seven.

09:43:45 8 A. Sorry.

09:43:46 9 Q. Okay. Any of them deal with forced-air

09:43:52 10 warming?

09:43:52 11 A. No.

09:43:53 12 Q. Any of them deal with patient-warming

09:43:55 13 devices?

09:43:55 14 A. No.

09:43:56 15 Q. Would most of them be with respect to burn

09:43:59 16 cases?

09:44:00 17 A. No.

09:44:02 18 Q. What were the six or seven?

09:44:06 19 A. I've given a deposition related to a burn

09:44:09 20 case. I've given a number of depositions related to

09:44:16 21 intellectual property litigation. In fact I think, I

09:44:23 22 am quite certain, that the remaining depositions were

09:44:25 23 related to intellectual property cases.

09:44:28 24 Q. Okay. So one burn case and the rest dealing

09:44:31 25 with intellectual property cases.

09:44:34 1 A. Correct.

09:44:35 2 Q. And they would be patent litigation cases?

09:44:39 3 A. Correct, if -- if "patent litigation cases"

09:44:42 4 would include things like International Trade

09:44:47 5 Commission, Inter Partes Review.

09:44:49 6 Q. Okay.

09:44:50 7 A. But I would just say within the intellectual

09:44:52 8 property realm.

09:44:55 9 Q. Okay.

09:44:55 10 A. I don't know if they are technically

09:44:57 11 considered patent litigation cases.

09:44:59 12 Q. Fair enough.

09:45:00 13 Now as an expert in this case you agree with

09:45:03 14 me that you are supposed to be objective.

09:45:05 15 A. Yes.

09:45:07 16 Q. You're not supposed to be an advocate for

09:45:10 17 either side in this case; correct?

09:45:11 18 A. Correct.

09:45:11 19 Q. And as a professor, you agree that providing

09:45:14 20 false data or results would be fraudulent.

09:45:16 21 A. Correct.

09:45:17 22 Q. Okay. And if your research provided false

09:45:23 23 data or results that would be considered research

09:45:25 24 fraud; correct?

09:45:28 25 A. If it knowingly --

09:45:29 1 I think if it's knowingly fraudulent, then  
09:45:31 2 yes.

09:45:31 3 Q. Okay. And I take it you would never commit  
09:45:33 4 research fraud or put your name on a court document  
09:45:35 5 that you did not believe in.

09:45:37 6 A. Correct.

09:45:39 7 Q. You do understand that you are under oath  
09:45:41 8 today; correct?

09:45:42 9 A. Correct.

09:45:43 10 Q. And that's under penalty of perjury;  
09:45:45 11 correct?

09:45:45 12 A. Correct.

09:45:45 13 Q. And you understand what that means; correct?

09:45:48 14 A. I think I do.

09:45:52 15 Q. Did your lawyer not explain to you that  
09:45:54 16 sitting here today is like sitting in a courtroom,  
09:45:58 17 you're under oath and the same rules apply and the  
09:46:00 18 same penalties apply?

09:46:02 19 A. I understand that.

09:46:03 20 Q. Okay. And by the way, do you like to be  
09:46:05 21 called Mr. Abraham, Dr. Abraham, John, what do you  
09:46:09 22 like?

09:46:09 23 A. For a deposition I'd prefer Dr. Abraham.

09:46:11 24 Q. Okay. So Dr. Abraham, do you agree, or can  
09:46:15 25 we agree that if for any reason you discover that one

20

09:46:19 1 of the opinions you put in your report is incorrect,  
09:46:23 2 or not accurate, or if you even change your opinions  
09:46:26 3 today, that -- that you will tell me today?

09:46:30 4 A. Yes.

09:46:31 5 Q. Okay. This is the time for me to take your  
09:46:34 6 deposition and ask you questions about your opinions  
09:46:41 7 and all your opinions in this case. You understand  
09:46:43 8 that.

09:46:43 9 A. Yes.

09:46:44 10 Q. Okay. And when I leave here today I expect  
09:46:47 11 to have all your opinions outlined and understood that  
09:46:54 12 I could go back through the deposition and read. You  
09:46:56 13 understand that?

09:46:57 14 A. I understand that.

09:46:58 15 Q. Okay. You understand that I'm one of the  
09:46:59 16 attorneys working on behalf of over 2700 people who  
09:47:03 17 have filed lawsuits against 3M that they were harmed  
09:47:06 18 by the Bair Hugger.

09:47:07 19 A. I do not understand that.

09:47:08 20 Q. Okay. Do you understand that there's been  
09:47:10 21 over 2700 lawsuits in this case, in this litigation in  
09:47:14 22 Minnesota?

09:47:14 23 A. I do not understand that.

09:47:15 24 Q. Okay. So you, sitting here today, you don't  
09:47:21 25 know how many cases were fi -- have been filed.

09:47:22 1 A. Correct.

09:47:23 2 Q. Okay. Did you understand there were many

09:47:25 3 cases that were filed?

09:47:30 4 A. I would say I know there are a number of

09:47:32 5 cases filed. "Many" -- I don't know the number.

09:47:36 6 Q. Okay.

09:47:39 7 A. Sitting here right now I do not know the

09:47:44 8 number of cases filed.

09:47:51 9 Q. You also understand that the plaintiffs have

09:47:56 10 a right to determine all the methodologies you used to

09:47:57 11 reach your opinions.

09:47:57 12 A. Correct.

09:47:58 13 Q. Okay. So that at the end we could test

09:48:03 14 whether or not your methodologies are reliable.

09:48:06 15 A. Correct.

09:48:07 16 Q. And do you understand what I mean by

09:48:08 17 "reliable"?

09:48:10 18 A. Yes.

09:48:11 19 Q. Like reproducible.

09:48:13 20 A. Yes.

09:48:13 21 Q. Okay.

09:48:24 22 A. Actually that may not be quite right. You

09:48:26 23 could have results which are reliable, but they may

09:48:35 24 not be reproducible.

09:48:38 25 Q. Okay. What do you mean by that in the

09:48:42 1 science -- with respect to research in the scientific  
09:48:45 2 community?

09:48:45 3 A. Let me give you an example. I work on areas  
09:48:50 4 of patient-specific medical interventions, and let's  
09:49:00 5 say I did an experiment on someone, on a person, and  
09:49:08 6 let's say that person died or was other -- otherwise  
09:49:15 7 unavailable for a repeat experiment. Someone could  
09:49:20 8 not reproduce the experiment on that person, and  
09:49:23 9 reproducing it on someone else would be slightly  
09:49:26 10 different.

09:49:26 11 Q. Let me define it, then. I understand that  
09:49:29 12 one outlier.

09:49:30 13 But with respect to your issues in this  
09:49:35 14 case, computational fluid dynamics, heat transfer, the  
09:49:40 15 laws of thermodynamics, you agree with me that if  
09:49:44 16 something is reliable, it should be reproducible.

09:49:48 17 A. Yes.

09:49:51 18 Q. Okay. So moving on.

09:50:15 19 (Discussion off the stenographic record.)  
20 (Abraham Exhibit 1 marked for  
21 identification.)

22 BY MR. ASSAAD:

09:50:15 23 Q. What's been marked as Exhibit 1 is a copy of  
09:50:18 24 your report that is -- was submitted to the plaintiffs  
09:50:22 25 on June 2nd, 2017. I'll represent to you that this is

09:50:27 1 a copy -- a true copy of your report. If you want to  
09:50:29 2 review it, you can review it at a break, but I don't  
09:50:33 3 want to get into that issue right now.

09:50:36 4 Now my understanding is that this report  
09:50:50 5 deals with the Bair Hugger Model 750 or 775; correct?

09:50:58 6 A. The Bair Hugger model is listed, I think

09:51:01 7 it's the --

09:51:06 8 Is it listed in this report? If it's not  
09:51:18 9 listed, then I'll say yes to that.

09:51:21 10 Q. Okay.

09:51:40 11 A. Yes, it's listed on page 5, third paragraph  
09:51:43 12 from the bottom.

09:51:45 13 Q. Okay. And this report you do not --

09:51:53 14 This report does not contain anything with  
09:51:54 15 respect to any studies done on the Model 505; correct?

09:52:01 16 A. This report does not.

09:52:03 17 Q. Okay.

09:52:03 18 A. However, since drafting this report I have  
09:52:06 19 analyzed that blower system.

09:52:09 20 Q. Okay. When was this report drafted?

09:52:21 21 A. I'm going to estimate.

09:52:23 22 Q. Okay.

09:52:23 23 A. I would estimate early 2016, but I don't  
09:52:31 24 have an exact date.

09:52:39 25 Q. And what was when you -- when you completed

09:52:41 1 the final draft was early 2016?

09:52:43 2 A. No.

09:52:45 3 Q. Okay. When did you complete the final

09:52:47 4 draft?

09:52:49 5 A. Well the final draft would have been

09:52:52 6 completed after I received the expert report from Dr.

09:52:57 7 Elghobashi, so that part was added, that section was

09:53:03 8 added after -- after that date.

09:53:05 9 Q. Okay. Could we -- Could we --

09:53:08 10 I'm going to just give you page numbers and

09:53:10 11 let me just see if we could go through this quickly.

09:53:13 12 Would you agree with me that pages 1 through

09:53:21 13 10, the first part, was completed by early 2016?

09:53:36 14 A. You said "10, the first part"?

09:53:38 15 Q. Page 10 and -- with paragraph subtitled B.

09:53:43 16 A. Yes. I -- To my best recollection, that

09:53:46 17 would have been completed early 2016.

09:53:48 18 Q. Okay. And then the part with respect to the

09:53:51 19 schlieren and -- and the criticisms of Elghobashi

09:53:58 20 would have been done probably this year, after you

09:54:01 21 received those reports.

09:54:02 22 A. Correct.

09:54:03 23 Q. Okay. And you've kept detailed bills with

09:54:12 24 respect to all the work you've done in this case.

09:54:13 25 A. Yes.

25

09:54:14 1 Q. Okay. So would you agree with me that this  
09:54:19 2 report was completed with respect to your CFD, not  
09:54:23 3 your criticisms of the schlieren, prior to Science Day  
09:54:27 4 where you testified in front of the Court in this  
09:54:29 5 case?

09:54:30 6 A. Yes.

09:54:46 7 Q. And let me just correct one thing. Go to  
09:54:50 8 page 11 and the top of 12. Was that -- part D,  
09:54:59 9 section D. Would that have been part of your report  
09:55:02 10 in January of 2016, or was that added later on?

09:55:12 11 A. That would have been part of the original,  
12 the early --

13 Q. Okay.

09:55:16 14 A. -- the early report.

09:55:19 15 Q. Okay. So now we have, just to be clear and  
09:55:21 16 for the record, pages 1 through 10 of -- section B of  
09:55:28 17 10, and pages 11, section D, which completes on  
09:55:31 18 section 12, was all completed in January of 2016.

09:55:34 19 MR. GOSS: Object to form.

09:55:36 20 MR. ASSAAD: Basis?

09:55:37 21 MR. GOSS: I think he said "early" 2016.

09:55:39 22 Q. Early 2016.

09:55:41 23 A. That is the best of my recollection.

09:55:43 24 Q. And definitely before Science Day in this  
09:55:45 25 case.

09:55:46 1 A. Yes.

09:55:47 2 Q. Okay. Now for today's deposition all my

09:56:00 3 questions will be with respect to the report that we

09:56:06 4 have as -- marked as Exhibit 1. You understand that.

09:56:08 5 A. I understand it because you've just told me.

09:56:10 6 Q. Okay. Any work that you did on the 505 is

09:56:13 7 not part of this report so we're not going to talk

09:56:15 8 about that today. You understand that?

09:56:17 9 A. I do.

09:56:17 10 Q. Okay.

09:56:28 11 (Abraham Exhibit 2 marked for

12 identification.)

13 BY MR. ASSAAD:

09:56:39 14 Q. What's been marked as Exhibit 2 is a copy of

09:56:41 15 your curriculum vitae that was provided to us with

09:56:44 16 your report. Is this the most --

09:56:46 17 Is this an accurate copy of your CV?

09:57:03 18 A. (Witness reviewing exhibit.) This would be

09:57:12 19 an accurate copy of my CV at the time it was produced.

09:57:16 20 Q. Okay. I assume there might be a few new

09:57:18 21 publications?

09:57:19 22 A. Correct.

09:57:20 23 Q. Any publications dealing with

09:57:24 24 patient-warming devices?

09:57:25 25 A. No.

09:57:28 1 Q. Any publications dealing with the issues in  
09:57:30 2 this case?

09:57:30 3 A. No.

09:57:31 4 Q. Okay. And it seems like you've written  
09:57:37 5 about 100, 102 publications since 2010.

09:57:42 6 A. That sounds about right.

09:57:43 7 Q. Okay. About 15 publications per year; that  
09:57:47 8 sound about right?

09:57:47 9 A. Yes.

09:57:48 10 Q. Okay. And I take it these are publications  
09:57:50 11 which you have worked with research students as their  
09:57:56 12 advisor, or research that St. Thomas is doing that  
09:57:59 13 you've coauthored with other people; correct?

09:58:02 14 A. Oftentimes, yes.

09:58:03 15 Q. Okay. Are you the main writer in many of  
09:58:06 16 these publications, or just the advisor overseeing the  
09:58:12 17 research?

09:58:13 18 A. I am usually the main writer.

09:58:15 19 Q. Okay. Now --

20 (Abraham Exhibit 3 marked for  
21 identification.)

22 BY MR. ASSAAD:

09:58:35 23 Q. What's been marked as Exhibit 3 is a  
09:58:38 24 document that was provided to us of all the materials  
09:58:40 25 you considered with respect to your expert report of

09:58:45 1 Exhibit 1. Do you recall this document?

09:58:49 2 A. No.

09:58:50 3 Q. Have you ever seen this document before?

09:58:54 4 A. I don't recall seeing this document.

09:58:56 5 Q. Okay. This was provided to us by defense

09:58:58 6 counsel discussing all the materials considered by you

09:59:04 7 in -- in -- and relied upon in formulating your

09:59:10 8 opinions in this case.

09:59:10 9 Do you agree with me that this is a complete

09:59:13 10 list of the materials you considered that formulated

09:59:18 11 your opinions in -- that are identified in Exhibit 1?

09:59:25 12 Let me rephrase that. I'm going to go back

09:59:28 13 a little bit.

09:59:29 14 Exhibit 1 has references; correct?

09:59:34 15 A. Correct.

09:59:35 16 Q. Okay. So if you take those references along

09:59:37 17 with this Exhibit 3, would that constitute all the

09:59:40 18 materials you considered and relied upon in

09:59:43 19 formulating your opinions?

10:00:12 20 A. (Witness reviewing exhibits.) We'd have to

10:00:13 21 include the -- the videos, which I -- which I mention

10:00:19 22 explicitly in the report. They're not in the

10:00:21 23 reference list of the report. I'm trying to think of

10:00:29 24 anything that would not be in these two groups.

10:00:40 25 Sitting here now I cannot think of anything

10:00:44 1 not in one of these two groups.

10:00:47 2 Q. Okay. And if you do later on, just say,

10:00:51 3 hey, I forgot to include this on Exhibit C.

10:00:54 4 A. Thank you.

10:00:55 5 Q. Okay?

10:00:57 6 Now have you had a chance to review your

10:01:12 7 report before today's deposition?

10:01:14 8 A. I didn't quite hear that question. Could

10:01:16 9 you --

10:01:16 10 Q. Have you reviewed your report before today's

10:01:18 11 deposition?

10:01:19 12 A. Yes.

10:01:19 13 Q. Okay. And I assume you met with counsel and

10:01:22 14 went over your report; correct?

10:01:28 15 A. I met with counsel, but I don't recall going

10:01:30 16 over the report.

10:01:31 17 Q. Okay. But you recently reviewed your

10:01:33 18 report.

10:01:33 19 A. Yes.

10:01:34 20 Q. Any corrections you would like to make to

10:01:36 21 your report before we begin discussing your report?

10:01:40 22 A. Not at this time.

10:01:41 23 Q. Okay. All the opinions you intend to offer

10:01:43 24 to the court and the jury in this matter are contained

10:01:45 25 in your report; correct?

10:01:52 1 A. Well the only other opinion that I have  
10:01:55 2 that's not in this report is that lower flow blankets  
10:02:00 3 -- lower flow forced-air warming devices also do not  
10:02:03 4 interrupt the airflow in an operating room, but aside  
10:02:05 5 from that, yes.

10:02:07 6 Q. When you say "lower flow," are you talking  
10:02:08 7 about devices such as the Mistral?

10:02:11 8 A. No.

10:02:12 9 Q. What -- What's lower flow?

10:02:14 10 A. 505.

10:02:14 11 Q. Okay. You stand by your report?

10:02:26 12 A. Yes.

10:02:27 13 Q. You checked your report for any type of  
10:02:28 14 error, mathematical or computational?

10:02:31 15 A. Yes.

10:02:32 16 Q. And you believe that all the numbers in your  
10:02:33 17 report are correct.

10:02:34 18 A. Yes.

10:02:35 19 Q. Okay. My understanding is, and I'll get  
10:02:38 20 into more detail, but the main opinions I obtained  
10:02:41 21 from your report is that the Bair Hugger does not  
10:02:43 22 disrupt airflow; correct? Over the surgical site.

10:02:48 23 A. That is one opinion.

10:02:49 24 Q. Okay. That the Bair Hugger does not  
10:02:52 25 increase the temperature around the surgical table.

10:02:58 1 A. That is another opinion.

10:03:00 2 Q. Okay. You also claim that you val -- you

10:03:03 3 validated your CFD by temperature measurements;

10:03:07 4 correct?

10:03:08 5 A. Correct.

10:03:09 6 Q. And you did that by doing measurements on

10:03:12 7 the floor and the edge of the bed; correct?

10:03:16 8 A. Those were two locations, correct.

10:03:18 9 Q. Were there any other locations that you

10:03:19 10 measured temperature?

10:03:20 11 A. Yes.

10:03:20 12 Q. Where else?

10:03:30 13 A. I took a number of temperatures in the room.

10:03:33 14 Q. And what page are you looking at?

10:03:34 15 A. The bottom of page 5.

10:03:36 16 Q. Okay.

10:03:37 17 A. And had a room average temperature of 62

10:03:42 18 degrees Fahrenheit. And I think you mentioned on the

10:03:50 19 -- near the floor, I think you mentioned that.

10:03:52 20 Q. Yes.

10:03:53 21 A. That's one location. And yes, at the edge

10:03:55 22 of the bed.

10:03:56 23 Q. I'm going to correct you for a little bit.

10:03:57 24 I believe you measured -- your experimental

10:03:59 25 measurements was 61 and your calculated measurements

10:04:02 1 were 62 for an 8.1 million-grid-cell calculation.

10:04:07 2 A. Thank you for that correction.

10:04:09 3 Q. Okay. My understanding is besides those

10:04:31 4 temperature measurements that we've just identified,

10:04:33 5 you did not take any other temperature measurements in

10:04:36 6 the room during your experiment.

10:04:38 7 A. Correct.

10:04:39 8 Q. You did not take any measurements of the

10:04:42 9 drape temperature; correct?

10:04:44 10 A. Correct.

10:04:44 11 Q. You did not take any measurements of the

10:04:46 12 temperature above the surgical site.

10:04:50 13 A. Correct.

10:04:53 14 Q. And if you go to page 12 of your report, you

10:04:56 15 would agree with me that this is a -- a represent --

10:05:00 16 this is a view of the temperature represented in the

10:05:07 17 operating room with respect to your CFD analysis along

10:05:11 18 that plane.

10:05:12 19 A. Yes.

10:05:12 20 Q. Okay. And my understanding is also

10:05:17 21 validated by smoke tests?

10:05:22 22 A. I don't know if I used the word "smoke."

10:05:24 23 Did I use the word "smoke" in this?

10:05:26 24 Q. I don't know. Did --

10:05:27 25 I mean, did you use smoke tests?

10:05:29 1 A. Well technically it's not smoke.

10:05:31 2 Q. It's water vapor; correct?

10:05:37 3 A. Visible --

10:05:38 4 Condensed water droplets.

10:05:39 5 Q. Okay.

10:05:42 6 A. And maybe for -- for this deposition I'm

10:05:42 7 going to use the term "visible water vapor," but --

10:05:46 8 Q. Okay.

10:05:48 9 A. -- but that's a -- that's not a technical

10:05:49 10 term.

10:05:49 11 Q. So you used visible water vapor in your

10:05:52 12 validation; correct?

10:05:54 13 A. Correct.

10:05:54 14 Q. Okay. And you did that yourself.

10:05:57 15 A. Yes.

10:05:59 16 And let me go back to a question you asked,

10:06:01 17 did I measure any other temperatures? I actually did

10:06:05 18 one that I had forgotten about. I measured the

10:06:08 19 temperature of the water vapor emerging from the water

10:06:12 20 vapor machine.

10:06:13 21 Q. What was that temperature?

10:06:15 22 A. I recall it 62.5 Fahrenheit.

10:06:20 23 Q. Do you have that written down somewhere?

10:06:22 24 A. Yes.

10:06:22 25 Q. Okay. And what device did you use for the

10:06:27 1 visible water -- visible water machine?

10:06:34 2 A. I recall it's a megasonic fog generator.

10:06:40 3 Q. Can we just call it fog, a fog generator?

10:06:43 4 A. Perfect.

10:06:44 5 Q. Okay. That's much easier to say than the

10:06:46 6 "visible water."

10:06:47 7 A. I agree.

10:07:00 8 Q. Is a fog generator a generally accepted

10:07:05 9 method in the scientific community to validate CFD?

10:07:10 10 A. Yes.

10:07:32 11 (Abraham Exhibit 4 marked for

12 identification.)

13 BY MR. ASSAAD:

10:07:44 14 Q. What's been marked as Exhibit 4 is a

10:07:46 15 subpoena issued by myself to you dated June 7th, 2017

10:07:52 16 for you to provide documents by June 21st, 2017.

10:07:59 17 Have you seen this document before?

10:08:01 18 A. Yes.

10:08:01 19 Q. Okay. And this was given to you by counsel

10:08:04 20 for 3M when they received it; correct?

10:08:06 21 A. Yes.

10:08:07 22 Q. Did you go through the subpoena and produce

10:08:09 23 documents to 3M's attorneys that are responsive to

10:08:13 24 this subpoena?

10:08:16 25 A. No.

10:08:17 1 Q. Why not?

10:08:19 2 A. I don't believe --

10:08:20 3 Well I produced the documents to Blackwell

10:08:23 4 Burke attorneys, --

10:08:24 5 Q. Yes.

10:08:24 6 A. -- not to 3M attorneys.

10:08:26 7 Q. They're 3M attorneys.

10:08:27 8 A. Oh.

10:08:27 9 (Laughter.)

10:08:28 10 A. My naivete on this whole matter, the legal

10:08:33 11 matters.

10:08:33 12 Q. Okay. Okay.

10:08:33 13 A. But yes, I produced documents to Blackwell

10:08:39 14 Burke attorneys related to this subpoena.

10:08:40 15 Q. Okay. Let's go to page four. Now you

10:08:47 16 mentioned -- I'm going to only go through a few of

10:08:49 17 them. You just mentioned you had some notes that you

10:08:53 18 created during your whole -- the whole process of

10:08:56 19 preparing -- of taking data and preparing your report?

10:08:59 20 A. No. I did not say that.

10:09:01 21 Q. So you said the 62.5 temperature for the fog

10:09:03 22 generator, you said that was written down someplace.

10:09:06 23 A. That's correct.

10:09:07 24 Q. Where is it written down?

10:09:08 25 A. It's written down in a manuscript submitted

10:09:10 1 to a journal, but it's not a note.

10:09:14 2 Q. Okay. So you've submitted this -- the -- a

10:09:19 3 manuscript to a journal in this case --

10:09:20 4 A. Yes.

10:09:20 5 Q. -- regarding your testing?

10:09:22 6 Who are the authors of that journal, or that

10:09:24 7 manuscript?

10:09:27 8 A. Well I -- I wrote the manuscript.

10:09:35 9 Q. Is it listed in your resume?

10:09:36 10 A. Yes, it is.

10:09:37 11 Q. Okay.

10:09:38 12 A. It is the number one listing under the

10:09:41 13 wor -- section "Publications."

10:09:58 14 Q. So do you have a copy of this manuscript

10:10:04 15 with you today?

10:10:05 16 A. No.

10:10:06 17 Q. Has it been accepted?

10:10:08 18 A. Yes.

10:10:09 19 Q. Okay. And in there it talks about the Bair

10:10:14 20 Hugger?

10:10:16 21 A. I don't know if the name Bair Hugger is

10:10:19 22 used.

10:10:20 23 Q. Does it talk about a forced-air warming

10:10:23 24 device?

10:10:23 25 A. Yes.

10:10:24 1 Q. Okay. And is it with the 505 or the 750  
10:10:27 2 model?  
10:10:28 3 A. Both.  
10:10:28 4 Q. Okay. And you wrote this with B. D.  
10:10:35 5 Plourde; is that how you pronounce it?  
10:10:37 6 A. Plourde.  
10:10:38 7 Q. Plourde. And Ms. Vallez?  
10:10:40 8 A. Correct.  
10:10:41 9 Q. Okay. Did those two assist you with the CFD  
10:10:44 10 analysis that is the subject of your report?  
10:10:56 11 A. No.  
10:10:58 12 Q. So it's my understanding that the report --  
10:11:04 13 the -- the creation of the CFD and the results was all  
10:11:08 14 created by you?  
10:11:10 15 A. All of the results contained in the document  
10:11:13 16 and in my expert report were created by me.  
10:11:17 17 Q. What about the geometry?  
10:11:19 18 A. The geometry was not created by me.  
10:11:21 19 Q. Who was it created by?  
10:11:23 20 A. I don't know the answer to that.  
10:11:29 21 Q. Was it given to you?  
10:11:30 22 A. Yes.  
10:11:31 23 Q. By whom?  
10:11:33 24 A. If I recall, it was supplied by an attorney,  
10:11:38 25 but it would have been two years ago. I don't recall

10:11:41 1 the person.

10:11:43 2 Q. Was it Lori Cohen?

10:11:45 3 A. No.

10:11:46 4 Q. Christiana Jacxsens?

10:11:49 5 A. No.

10:11:49 6 Q. Evan Holden?

10:11:50 7 A. No.

10:11:51 8 Q. Okay. Was it someone from Greenberg

10:11:54 9 Traurig?

10:11:55 10 A. I believe so.

10:11:58 11 Q. And this was submitted to *Numerical Heat*

10:12:01 12 *Transfer*, your -- a journal, we're discussing?

10:12:03 13 A. Yes.

10:12:03 14 Q. Okay. And when's it going to be published?

10:12:06 15 A. I don't know.

10:12:06 16 Q. Okay. On the journal, did you inform the

10:12:17 17 journal that this research was funded by 3M?

10:12:20 18 A. Yes. It is listed in the supporting section

10:12:23 19 or the acknowledgment section.

10:12:25 20 Q. Okay. Did you inform the journal that the

10:12:38 21 geometry that was created was not created by you?

10:12:40 22 A. No.

10:12:47 23 Q. Where did you obtain the data that you --

10:12:50 24 the 62.5 degrees for the journal? Did you have that

10:12:55 25 just memorized regarding the temperature of the fog

10:12:57 1 generator?

10:12:58 2 A. Yes.

10:12:58 3 Q. Okay. So my understanding is you did not

10:13:03 4 create any notes.

10:13:07 5 A. Incorrect.

10:13:08 6 Q. So you did create notes.

10:13:09 7 A. Yes.

10:13:11 8 Q. Where are the notes?

10:13:12 9 A. I had one note on a yellow sheet of paper  
10:13:16 10 like this [indicating], a note to myself about whether  
10:13:20 11 I had a reference, a certain reference. And when I  
10:13:25 12 confirmed that I had the reference, I discarded that  
10:13:27 13 note.

10:13:28 14 Q. Okay. So sitting here today there are no  
10:13:30 15 written notes in your possession regarding your  
10:13:33 16 research or your analysis performed in your expert  
10:13:38 17 report.

10:13:41 18 A. Sitting here today there are no notes  
10:13:44 19 regarding the analysis in my expert report. The only  
10:13:48 20 other notes that I would have would be annotations on  
10:13:50 21 journal papers, as I read through journal papers and I  
10:13:54 22 make notes.

10:13:54 23 Q. On the journal papers?

10:13:56 24 A. Correct.

10:13:58 25 Q. Okay. Did you provide those to 3M's

10:13:59 1 counsel?

10:14:00 2 A. No.

10:14:55 3 Q. Did Mr. Plourde or Ms. Vallez provide any

10:15:04 4 work with respect to the CFD analysis you performed on

10:15:12 5 the 750?

10:15:14 6 A. No.

10:15:15 7 Q. So even though part of your agreement with

10:15:20 8 3M was to -- that the money was to be used for a staff

10:15:24 9 member and a student, you did not obtain a student or

10:15:27 10 a -- or a staff member to work on the project.

10:15:31 11 A. Incorrect.

10:15:31 12 Q. So you did obtain a student.

10:15:33 13 A. Yes.

10:15:34 14 Q. What student did the work?

10:15:38 15 A. Lauren Vallez.

10:15:39 16 Q. Okay. So she did help you on the 750

10:15:41 17 analysis?

10:15:41 18 A. Incorrect.

10:15:43 19 Q. Okay.

10:15:53 20 (Discussion off the stenographic record.)

21 (Abraham Exhibit 5 marked for

22 identification.)

23 BY MR. ASSAAD:

10:16:08 24 Q. What's been marked as Exhibit 5 is a

10:16:10 25 document that the plaintiffs have received yesterday,

10:16:13       1 June -- July 19th, 2017 in response to the subpoena.

10:16:17       2 Do you recog --

10:16:18       3                  Do you recognize what's been marked as

10:16:19       4 Exhibit 15 -- or Exhibit 5?

10:16:22       5 A.     Yes.

10:16:23       6 Q.     Okay. And this is the research proposal

10:16:26       7 written by you to 3M; correct?

10:16:28       8 A.     Yes.

10:16:29       9 Q.     Even though you were dealing with 3M's

10:16:31       10 attorneys at the time, which was Greenberg Traurig,

10:16:34       11 this proposal is directed to 3M; correct?

10:16:37       12 A.     Correct.

10:16:38       13 Q.     Okay. And in the last paragraph it says:

10:16:40       14 "The duration and cost of this project is \$12,000 and

10:16:43       15 one month. This is a fixed cost grant and will

10:16:46       16 support the employment of one student, one staff

10:16:48       17 member, and all other university costs."

10:16:51       18                  Did I read that correctly?

10:16:53       19 A.     Yes.

10:16:53       20 Q.     Was a student employed with respect to this

10:16:57       21 project?

10:16:57       22 A.     Yes.

10:16:58       23 Q.     Who?

10:16:59       24 A.     Lauren Vallez.

10:17:00       25 Q.     Okay. What did she do on the project?

10:17:03 1 A. She actually didn't accomplish anything.

10:17:08 2 The -- It turns out the simulation was very

10:17:12 3 challenging and she wasn't able to contribute

10:17:16 4 meaningfully in any way. She didn't contribute in any

10:17:21 5 way to the generation of the mesh, to the setting of

10:17:26 6 the boundary conditions, and to the analysis.

10:17:29 7 Q. Okay.

10:17:30 8 A. But she was still paid.

10:17:32 9 Q. Okay. And was there a staff member used?

10:17:35 10 A. Yes.

10:17:35 11 Q. Who?

10:17:36 12 A. Brian Plourde.

10:17:38 13 Q. Okay. What was his role in -- with respect

10:17:40 14 to the CFD analysis?

10:17:43 15 A. It was the same. It turns out the

10:17:45 16 calculations -- All of the calculations in the report

10:17:48 17 and in the journal paper were done by me. The problem

10:17:52 18 was too complex and the timeline was too short for him

10:17:56 19 to contribute meaningfully.

10:17:58 20 Q. So you agree with me that the -- the model

10:18:01 21 is a complex model.

10:18:04 22 A. Yes.

10:18:05 23 Q. Okay. All right. Did the lawyers in this

10:18:37 24 case provide you any documents?

10:18:40 25 A. Yes.

10:18:41 1 Q. Well they provided you the geometry;  
10:18:43 2 correct?  
10:18:44 3 A. Yes.  
10:18:45 4 Q. But with respect to documents, what  
10:18:47 5 documents did they provide you?  
10:18:54 6 A. I was provided a literature archive.  
10:18:58 7 Q. Is that listed in -- in any of your  
10:19:00 8 references or Exhibit 3?  
10:19:04 9 A. Probably not because I did not use their  
10:19:06 10 literature archive.  
10:19:08 11 Q. Okay.  
10:19:09 12 A. I was provided deposition transcripts.  
10:19:12 13 Q. Okay.  
10:19:19 14 A. I'm trying to -- I'm struggling to think of  
10:19:22 15 oth --  
10:19:22 16 Other things may come to my mind, but those  
10:19:24 17 were the two big things.  
10:19:26 18 Q. Did they provide any internal documents,  
10:19:27 19 internal testing of the Bair Hugger?  
10:19:30 20 A. They -- There was a document of flow through  
10:19:37 21 a Bair Hugger. Yes, they did provide a document.  
10:19:39 22 Q. And what was that document?  
10:19:44 23 A. Oh, man. It might have been called tech,  
10:19:49 24 tech documents or something. All I remember from the  
10:19:52 25 document is there was some testing of the airflow

1 through a tube that fed a Bair Hugger. And I think  
10:19:54 2 that there was some schematics of an operating room,  
10:20:04 3 if I recall correctly.

10:20:06 4 Q. Did you use that document in any way with  
10:20:07 5 respect to your CFD analysis?

10:20:10 6 A. Yes.

10:20:10 7 Q. How did you use the document?

10:20:12 8 A. I confirmed my understanding of the airflow  
10:20:18 9 going through a Bair Hugger.

10:20:19 10 Q. And we're talking about determining the mass  
10:20:21 11 flow through the Bair Hugger?

10:20:23 12 A. Yes.

10:20:24 13 Q. Okay. Anything else you used in that  
10:20:26 14 document?

10:20:33 15 A. I don't believe so.

10:20:34 16 Q. Did you provide that document to counsel in  
10:20:36 17 response to our subpoena?

10:20:42 18 A. I'm certain -- I'm certain I would have  
10:20:45 19 provided that document.

10:20:46 20 Q. Okay.

10:20:48 21 MR. ASSAAD: Do you have that document?

10:20:50 22 MR. GOSS: I believe it was produced

10:20:54 23 separately in response to an earlier subpoena, when  
10:21:01 24 you subpoenaed Jennifer Wagner and John Abraham.

10:21:04 25 MR. ASSAAD: Well that's different than

1 subpoenaing him. I wanted to know what documents he  
10:21:08 2 had. And I don't want what document you're talking  
10:21:10 3 about or he's talking about, so I'd like to know what  
10:21:13 4 document you're referring to and get a copy of that.

10:21:16 5 If it's already been produced, then it  
10:21:18 6 should have been produced with his production;  
10:21:20 7 correct?

10:21:20 8 MR. GOSS: I'm saying it's already -- to my  
10:21:22 9 knowledge it's already been produced. We can  
10:21:23 10 identify it. I think I know what he's talking about.

10:21:27 11 MR. ASSAAD: So my understanding is 3M is  
10:21:29 12 only going to produce documents that Abraham has that  
10:21:33 13 was not produced previously according to the  
10:21:36 14 subpoena, even though the subpoena's directed to  
10:21:37 15 Abraham?

10:21:39 16 MR. GOSS: I think we did our best to  
10:21:41 17 comply with the subpoena. If we missed something  
10:21:43 18 we'll go back and look for it and supply it.

10:21:45 19 MR. ASSAAD: Well can I get it at the next  
10:21:47 20 break, please, if you know what you're talking about?

10:21:50 21 MR. GOSS: We will do our best to locate  
10:21:51 22 it.

10:21:51 23 MR. ASSAAD: Well it seems like you know  
10:21:53 24 what the document is, Peter Goss.

10:21:54 25 MR. GOSS: I think I do know what the

10:21:55 1 document is --

2 MR. ASSAAD: Well let's get --

10:21:56 3 MR. GOSS: -- Gabriel Assaad.

10:21:56 4 MR. ASSAAD: -- it produced then. Let's

10:21:57 5 get it produced then, please.

10:21:58 6 MR. GOSS: I will do my best.

10:22:01 7 THE WITNESS: And if I could continue?

10:22:03 8 Q. Sure.

10:22:03 9 A. Sitting here I remember, I think, some

10:22:10 10 communications with Augustine perhaps, or there may

10:22:15 11 have been some kind of communications, emails that I

10:22:21 12 received, but I don't recall what they were. And

10:22:36 13 those were not used in the -- in these reports.

10:22:55 14 Q. Did you produce all your files in this case?

10:23:04 15 A. I believe I did. I am pretty sure I did. I

10:23:07 16 mean certainly every file that is necessary for --

10:23:10 17 that went into these reports.

10:23:13 18 Q. What do you --

10:23:13 19 What do you mean, "every file that is"

10:23:15 20 necessary"?

10:23:17 21 A. Well, for example, I received a CAD file. I

10:23:26 22 did not reproduce that CAD file because I produced a

10:23:28 23 file in which the CAD file is contained.

10:23:31 24 Q. Okay. Let me tell you what I've got -- been

10:23:34 25 produced regarding files, you tell me if that's all

10:23:37 1 the files.

10:23:38 2 I was produced a AGDBT file. Is that the

10:23:42 3 CAD file?

10:23:43 4 A. Actually that would be the CAD file.

10:23:45 5 Q. Okay. And I was provided a TRN file, one

10:23:49 6 TRN file --

10:23:50 7 A. Yep.

10:23:52 8 Q. -- previously from the original subpoena.

10:23:55 9 A. Umm-hmm.

10:23:56 10 Q. Do you recall producing that?

10:23:56 11 A. Yes.

10:23:56 12 Q. And I received another TRN file that was

10:24:00 13 called the 2540 that is -- that was produced subject

10:24:07 14 to your -- the subpoena. Does that sound correct?

10:24:10 15 A. Yes.

10:24:10 16 Q. Are there any other files that you have?

10:24:15 17 A. I don't think there's any other files that I

10:24:16 18 have. I don't recall any other files that I have

10:24:21 19 sitting here now.

10:24:22 20 Q. Okay. So the only --

10:24:25 21 And I don't know this for sure, and I was

10:24:27 22 guessing based on the pictures that I received, but

10:24:29 23 the 2540, is that your work on the 505?

10:24:33 24 A. Yes, that's correct.

10:24:34 25 Q. And the one that was titled "Abraham," which

10:24:38 1 you might have it titled something different, but it  
10:24:41 2 was provided to us as Abraham 001, which was a Bates  
10:24:43 3 number, was the TRN file on the 750; correct?  
10:24:47 4 A. I don't know if that's the Bates number.  
10:24:49 5 Q. Okay.  
10:24:49 6 A. But the twenty -- 264.TRN would have been  
10:24:53 7 the results in CAD.  
10:24:56 8 Q. 254.  
10:24:57 9 A. 2540 is for the 505.  
10:25:00 10 Q. Okay. And the other one is the 750.  
10:25:01 11 A. Correct.  
10:25:01 12 Q. Are there any other TRN files for runs that  
10:25:04 13 you did that you changed later on?  
10:25:07 14 A. What do you mean by "changed"?  
10:25:08 15 Q. I mean, did you on -- did you only make one  
10:25:10 16 run, or did you refine, you know, and get multiple  
10:25:15 17 results and then came up with the final results?  
10:25:19 18 A. Yes, I did.  
10:25:22 19 Q. So are there other files showing those  
10:25:24 20 results?  
10:25:25 21 A. Yes.  
10:25:26 22 Q. And where are those?  
10:25:27 23 A. Those would be on my computer.  
10:25:28 24 Q. Do you have your computer here today?  
10:25:30 25 A. No. All of the results contained here are

10:25:35 1 from the 264 TRN, and other results are the sa -- give  
10:25:42 2 the same results as the ones shown here.  
10:25:45 3 Q. Just out of curiosity, what does "264" stand  
10:25:48 4 for?  
10:25:49 5 A. It's the time --  
10:25:52 6 It's a number indicator from the software as  
10:25:55 7 it saves results.  
10:25:58 8 Q. Okay. And what's the number mean? Does it  
10:26:01 9 mean anything?  
10:26:04 10 A. Time step.  
10:26:05 11 (Interruption by the reporter.)  
10:26:05 12 A. Time step.  
10:26:05 13 Q. Time step. Okay.  
10:26:11 14 Does it apply -- Is it a time --  
10:26:13 15 Does the value mean anything to you, 264?  
10:26:16 16 A. Yes.  
10:26:17 17 Q. What does it mean?  
10:26:18 18 A. It means it's the 264th calculation.  
10:26:28 19 Q. Calculation of what?  
10:26:29 20 A. Of the airflow in the room.  
10:26:31 21 Q. Okay. I might be confused, but I thought  
10:26:42 22 there was, like, thousands of calculations that the  
10:26:48 23 computer does before it gets a single result.  
10:26:51 24 A. That's correct.  
10:26:51 25 Q. So how can this --

10:26:54 1 So why would this only be such a small  
10:26:57 2 number, like 264, or am I mis -- or am I  
10:27:01 3 misunderstanding something?

10:27:02 4 A. Yeah. I think you're confused.

10:27:04 5 Q. I know I'm confused because we just agreed  
10:27:06 6 there's over a thousand calculations.

10:27:08 7 So what does -- Is the 264, is it 264  
10:27:11 8 calculations, or 264 results?

10:27:19 9 A. There are many millions of calculations, and  
10:27:24 10 in a problem like this you have to do the calculations  
10:27:27 11 in time, you march forward in time. And so you have  
10:27:32 12 to wait until what's called quasi-steady results  
10:27:38 13 occur. And I used the 264th step for my quasi-steady  
10:27:44 14 calculation.

10:27:48 15 Q. Okay. So it's the 264th step, not the 264th  
10:27:53 16 calculation.

10:27:57 17 A. It's the 264th step, which is the 264th  
10:28:02 18 calculation in time.

10:28:05 19 Q. Okay. I think I understand. Let me see if  
10:28:07 20 I get this.

10:28:08 21 Each step might have millions of  
10:28:14 22 calculations for each step; correct?

10:28:15 23 A. Correct.

10:28:16 24 Q. Okay. And each step represents a period of  
10:28:21 25 time.

10:28:21 1 A. Correct.

10:28:22 2 Q. And 264 is the 264th period of time that you

10:28:27 3 got a result.

10:28:29 4 A. Yes.

10:28:30 5 Q. So where are the other 263 results?

10:28:34 6 A. I -- I didn't archive them because the

10:28:37 7 results are enormous and they fill up the hard drive.

10:28:41 8 I think I have two others, just to verify that I re --

10:28:45 9 that I achieved steady state.

10:28:48 10 Q. Are they time steps before or after?

10:28:50 11 A. Both.

10:28:51 12 Q. How -- What's the -- the -- How far --

10:28:54 13 What number after?

10:28:56 14 A. I think 300.

10:28:57 15 Q. Okay. And what about before; do you

10:29:03 16 remember the --

10:29:04 17 A. I don't know.

10:29:05 18 Q. Okay. And I take it that 300, it actually

10:29:08 19 means something to you, the 300th time step?

10:29:12 20 A. Correct.

10:29:13 21 Q. Is a time step every second?

10:29:14 22 A. No.

10:29:15 23 Q. What's the time step, like in this case?

10:29:17 24 A. I don't recall what my time step was in the

10:29:19 25 calculation.

10:29:20 1 Q. Is that something that's in your report?

10:29:25 2 A. I'll have to look. (Witness reviewing

10:30:14 3 exhibit.)

10:30:14 4 Q. We have a lot to cover and I'm going to go

10:30:17 5 page-by-page, so let's look for it when we start going

10:30:20 6 page-by-page through your report later on, okay?

10:30:23 7 A. Great.

10:30:24 8 Q. So did you do any runs --

10:30:31 9 Did you do any other runs before you came

10:30:33 10 with your final -- before you came up with your final

10:30:36 11 results?

10:30:39 12 A. Yes.

10:30:40 13 Q. Okay. What were different about those runs?

10:30:45 14 A. A calculation like this requires an initial

10:30:49 15 guess. These are what are called iterative

10:30:54 16 calculations, so you're guessing and checking and

10:30:56 17 guessing and checking. If you have a reasonable

10:31:00 18 initial guess, it speeds the -- what we call the

10:31:05 19 convergence.

10:31:06 20 So I did a calculation to get an initial

10:31:08 21 guess, which I then used as an input. And the effect

10:31:14 22 of that was to speed the process.

10:31:16 23 Q. Okay. How many of those did you do?

10:31:19 24 A. I think I would have done one.

10:31:20 25 Q. Okay. Do you have those results?

10:31:22 1 A. No.

10:31:23 2 Q. So those have been destroyed.

10:31:25 3 MR. GOSS: Object to form.

10:31:27 4 A. Well, I mean I -- there's no reason to keep

10:31:30 5 them.

10:31:31 6 Q. That wasn't my question.

10:31:32 7 My question is: They're no longer -- They

10:31:34 8 no longer exist.

10:31:35 9 A. I no longer --

10:31:36 10 That's correct, they no longer exist.

10:31:38 11 Q. So you destroyed them.

10:31:39 12 MR. GOSS: Object to form.

10:31:42 13 Q. Let me -- Let me withdraw that question.

10:31:44 14 Do files --

10:31:46 15 Is this on your personal computer or a St.

10:31:49 16 Thomas computer?

10:31:50 17 A. St. Thomas computer.

10:31:51 18 Q. Okay. And do you have to go physically

10:31:57 19 delete the file, or are they automatically deleted

10:32:00 20 over a certain period of time?

10:32:01 21 A. I -- I actually do the deletion.

10:32:03 22 Q. So you deleted those files.

10:32:04 23 A. Correct.

10:32:06 24 Q. When did you delete those files?

10:32:07 25 A. Proba --

10:32:08 1 I don't know. I probably would have done it  
10:32:12 2 once I had obtained them and then I used the -- then I  
10:32:15 3 used them as the initial...  
10:32:16 4 I don't -- I don't know when I did.  
10:32:17 5 Q. Okay. Prior to writing this report?  
10:32:24 6 A. I would have to guess. I don't know.  
10:32:27 7 Q. So just so I understand, the only files  
10:32:30 8 available right now that you have on your computer are  
10:32:37 9 three -- with respect to the 750, are three TRN files,  
10:32:42 10 one which is the 264, one that's titled 300, and then  
10:32:47 11 one that's earlier than 264.  
10:32:49 12 A. Correct.  
10:32:50 13 Q. Okay. Any other files that you have  
10:32:51 14 available to you?  
10:32:52 15 A. No.  
10:32:54 16 Q. Okay. Are there any other files that you  
10:32:59 17 could obtain from your --  
10:33:01 18 Well let me ask you this: Do you still have  
10:33:03 19 the model?  
10:33:04 20 A. It's contained within the TRN.  
10:33:06 21 Q. Okay. So if I want --  
10:33:14 22 Can I reproduce your model through the TRN?  
10:33:17 23 A. Yes.  
10:33:17 24 Q. How would I do that?  
10:33:18 25 A. The TRN contains all of the information,

10:33:22        1     including the geometry, the mesh, the boundary  
10:33:26        2     conditions, the time stepping information. The TRN  
10:33:30        3     actually contains everything.

10:33:32        4     Q.     Okay. But it's at a certain time; correct?

10:33:39        5     A.     That is correct.

10:33:39        6     Q.     So how do I know what occurred before 264?

10:33:43        7     Can I go backwards?

10:33:49        8     A.     You cannot go backwards.

10:33:51        9     Q.     So how do I know what your time zero was?

10:33:55        10    A.    Well the time zero's not relevant because  
10:33:57        11    that's just your initial guess. So the time -- The  
10:34:01        12    time zero result has no physical meaning.

10:34:04        13    Q.    But in this TRN your initial guess was -- or  
10:34:08        14    your initial -- your time zero wasn't an initial  
10:34:12        15    guess, or it was an educated assumption based on a  
10:34:16        16    previous file that you created.

10:34:17        17    A.    That's correct.

10:34:18        18    Q.    Okay. And this was a steady-state model;

10:34:25        19    correct?

10:34:26        20    A.    No.

10:34:27        21    Q.    What was it then?

10:34:28        22    A.    It was an unsteady model.

10:34:31        23    Q.    Is that the same as transient?

10:34:32        24    A.    Yes.

10:34:33        25    Q.    Okay. I might have misunderstood you, but I

10:35:02 1 think you talked about converse or converge or  
10:35:05 2 convergence. Did you --  
10:35:07 3 You said something about convergence?  
10:35:09 4 A. Yes, I did.  
10:35:10 5 Q. What is --  
10:35:11 6 What is convergence?  
10:35:15 7 A. Convergence has two meanings.  
10:35:18 8 Q. In the CFD meaning.  
10:35:20 9 A. It has two CFD meanings.  
10:35:22 10 Q. Okay.  
10:35:22 11 A. Sorry.  
10:35:26 12 At each time step you can converge your  
10:35:29 13 solution to the correct solution. And another meaning  
10:35:34 14 is that over time you converge to a steady state, we  
10:35:39 15 call it quasi-steady result.  
10:35:43 16 Q. Okay. And is 264 a quasi-steady result?  
10:35:50 17 A. It was.  
10:35:51 18 Q. Okay. And that means that you came close to  
10:35:54 19 steady state?  
10:35:56 20 A. That means the results were no longer  
10:35:58 21 changing meaningfully over time.  
10:36:00 22 Q. Okay. Which is not true steady state, but  
10:36:04 23 quasi-steady state.  
10:36:05 24 A. That's correct.  
10:36:06 25 Q. Okay. I think I'm understanding this.

10:36:08 1 And how do you determine whether or not you  
10:36:22 2 have quasi-steady results?  
10:36:29 3 A. Well one way to determine that is to look at  
10:36:31 4 the results and see if they meaningfully change from  
10:36:33 5 one step to the next.  
10:36:36 6 Q. Okay. Are you looking at the results while  
10:36:38 7 you're running this?  
10:36:41 8 A. You can look at the results. I don't recall  
10:36:43 9 if I was, but you can look at them while you run.  
10:36:46 10 Q. Okay. And just so I understand that you're  
10:36:52 11 saying that if you looked at, I guess, time like 260,  
10:36:57 12 262, 263 and then 264, you're not seeing much of a  
10:37:02 13 change and therefore you could determine quasi-steady.  
10:37:05 14 A. That's correct.  
10:37:06 15 Q. Okay. And that is a judgment call based on  
10:37:08 16 the person doing the CFD.  
10:37:10 17 A. Yes.  
10:37:11 18 Q. Okay. Was there any correspondence between  
10:37:23 19 you and anyone besides attorneys for 3M regarding your  
10:37:29 20 work on this case, or your research work regarding the  
10:37:33 21 Bair Hugger?  
10:37:33 22 A. No.  
10:37:34 23 Q. What about with the journal?  
10:37:38 24 A. Oh, there would have been correspondence  
10:37:40 25 with the journal.

10:37:41 1 Q. Did you provide those to counsel?

10:37:45 2 A. I -- I don't recall if I did.

10:37:47 3 MR. GOSS: We would invoke the Ingelfinger

10:37:52 4 rule with respect to that correspondence.

10:37:52 5 MR. ASSAAD: That rule only applies during

10:37:54 6 the submission, but once it's accepted it no longer

10:37:58 7 applies. And according to his -- his publications

10:38:02 8 it's already been accepted.

10:38:03 9 MR. GOSS: All right. Well it's a

10:38:06 10 sauce-for-the-goose situation with respect to

10:38:08 11 Elghobashi's correspondence with his journal.

10:38:10 12 MR. ASSAAD: Well I'm telling you the

10:38:11 13 distinction here, sir. The distinction is Elghobashi

10:38:14 14 is still being under review. This has been accepted.

10:38:17 15 MR. GOSS: I'm not aware that it isn't

10:38:20 16 still under review.

10:38:21 17 MR. ASSAAD: It says right here,

10:38:22 18 "accepted."

10:38:22 19 MR. GOSS: Okay.

10:38:23 20 MR. ASSAAD: Exhibit 2, page 12, under the

10:38:28 21 number 1 publication, quote, accepted,

10:38:31 22 A-C-C-E-P-T-E-D, closed quote. So it's -- we're in a

10:38:36 23 different situation here.

10:38:37 24 Are you saying you're not going to produce

10:38:39 25 that document under the -- under the law?

10:38:40 1 MR. GOSS: We are not producing it today.

10:38:42 2 MR. ASSAAD: Okay. Let's take a break.

10:38:58 3 THE REPORTER: Off the record, please.

10:39:03 4 (Recess taken from 10:39 to 10:50 a.m.)

10:50:41 5 BY MR. ASSAAD:

10:50:56 6 Q. To determine whether or not you had a

10:50:58 7 quasi-steady result, what do you look at, in this

10:51:04 8 case?

10:51:04 9 A. The patterns of flow.

10:51:06 10 Q. When you say "patterns," what do you mean by

10:51:09 11 "patterns"?

10:51:10 12 A. In this case I looked at the streamlines,

10:51:13 13 which you can think of as an instantaneous pattern of

10:51:16 14 flow, and I compared streamlines.

10:51:19 15 Q. And is the streamline based on velocity?

10:51:23 16 A. Yes.

10:51:24 17 Q. Okay. Are you looking at the instantaneous

10:51:33 18 velocity or the average velocity?

10:51:34 19 A. Instantaneous.

10:51:37 20 Q. Okay. Did you look at anything else besides

10:51:39 21 the streamlines?

10:51:43 22 A. No.

10:51:47 23 Q. As you can see from Exhibit 5, which is the

10:51:51 24 St. Thomas proposal, I understood that's probably the

10:51:55 25 engagement agreement between -- to perform the study

10:51:57 1 on the 750 between St. Thomas and 3M; correct?

10:52:06 2 A. Yes.

10:52:06 3 Q. Okay. Are there any other engagement

10:52:08 4 agreements that exist with respect to your time on

10:52:11 5 this case as a consultant, an expert for 3M?

10:52:17 6 A. Well I would say this isn't one of those.

10:52:21 7 This isn't a engagement agreement with me as an

10:52:25 8 expert.

10:52:25 9 Q. I understand that.

10:52:26 10 I'm saying are there any engagement

10:52:28 11 agreements between you and 3M or the attorneys for 3M?

10:52:31 12 A. I -- I'm quite certain there isn't.

10:52:33 13 Q. Okay. Is there a similar document with

10:52:37 14 respect to Exhibit 5 for your work on the 505?

10:52:44 15 A. I think there was a working draft, but not a

10:52:46 16 final draft. I think the -- if I recall, the final

10:52:51 17 proposal was by -- was verbal.

10:52:53 18 Q. Okay. And I know I wasn't going to ask much

10:52:57 19 about the 505, but did you use the same type of

10:53:00 20 methodology on your analysis of the 505 as you did

10:53:02 21 with the 750?

10:53:04 22 A. Yes.

10:53:04 23 Q. Okay. And with respect to determining the

10:53:16 24 quasi-steady state by looking at the instantaneous

10:53:21 25 velocity, what did you consider a meaningful, I guess

10:53:26        1 the term was convergence, what change, like what would  
10:53:29        2 be a non-meaningful change that you could say this is  
10:53:32        3 quasi-steady state?

10:53:42        4 A. It was by visual inspection, not  
10:53:44        5 quantitative comparison.

10:53:47        6 Q. Okay. So if I asked you today to show me  
10:53:59        7 the results that you looked at to determine  
10:54:03        8 quasi-steady state that's something that you couldn't  
10:54:05        9 put together because you don't have those files any  
10:54:07        10 more; correct?

10:54:08        11 A. I disagree.

10:54:09        12 Q. Okay. What would you look at?

10:54:12        13 A. I could compare the results at two different  
10:54:14        14 time steps to show that there's no meaningful  
10:54:19        15 difference in the streamlines, and that's what I would  
10:54:22        16 provide you.

10:54:22        17 Q. Okay. So you'd compare it to the two other  
10:54:26        18 files that you have.

10:54:26        19 A. That's one way. Absolutely.

10:54:28        20 Q. What would be the other way?

10:54:29        21 A. It would be to compare two files.

10:54:32        22 Q. Okay. But the only files that you have are  
10:54:34        23 the 264, the 300 and another file before 264.

10:54:40        24 A. That -- Those are the two files related to  
10:54:44        25 this expert report. In my journal paper I made a

1 further comparison where the two results differed by  
2 maybe 2,000 time steps, and I did a side-by-side  
3 comparison of those.

4 Q. So you ran it again for your journal paper?

5 A. No.

6 Q. I'm really confused now. So --

7 A. It was the same calculation.

8 Q. What do you mean by the "same calculation"?

9 A. I ran the simulation once.

10 Q. And how far did you run it?

11 A. At least to 2500 time steps.

12 Q. Okay. And do you have any of that data  
13 available?

14 A. I may have the data at 2500, I would have to  
15 check. But that data would show that over that entire  
16 time period there's no meaningful difference. And  
17 that comparison was in -- is in the journal paper.

18 Q. Why did you not put that information in your  
19 expert report?

20 A. What I put in the expert report is this,  
21 images from figures 3 through 8 could be replicated --  
22 I'm on page 9 of Exhibit 1. "Images from figures 3-8  
23 could be replicated at other time instances and the  
24 same conclusions would be drawn."

25 So I assessed them and I state that the

10:56:21 1 results are the same at other instances.

10:56:25 2 Q. Okay. I assume there is much more detail in

10:56:44 3 your publication which is -- which has been submitted

10:56:50 4 for publication than in your expert report.

10:56:54 5 A. There's different detail. I don't know if

10:56:56 6 I'd say "much more," but there's different detail.

10:57:00 7 Q. What's the different detail?

10:57:01 8 A. Well, for example, in a journal paper I

10:57:03 9 would have never included a critique of Said

10:57:08 10 Elghobashi.

10:57:08 11 Q. I'm talking to the -- with respect to your

10:57:10 12 CFD analysis, not the critiques, but.

10:57:12 13 A. Thanks for that clarification.

10:57:16 14 There is more detail related to the CFD in

10:57:19 15 my journal paper.

10:57:20 16 Q. What detail is there in the journal paper?

10:57:22 17 A. Some equations are included.

10:57:23 18 Q. Okay.

10:57:25 19 A. I ran the -- a comparison with the

10:57:32 20 forced-air warming and without, and I also -- if I

10:57:37 21 recall correctly, I ran a case where I had a even

10:57:39 22 higher temperature coming out of the Bair Hugger than

10:57:42 23 is reasonable.

10:57:43 24 So I ran other cases for the journal paper.

10:57:48 25 Q. Okay. When you say "a higher temperature,"

10:58:07 1 what temperature?

10:58:08 2 A. For the journal paper I ran a calculation

10:58:12 3 where the temperature emerging from the Bair Hugger

10:58:14 4 was 43 Celsius.

10:58:16 5 Q. Okay. Now the opinions that you're going to

10:58:30 6 be giving in today's deposition, they're based on the

10:58:45 7 initial CFD analysis that was completed by January of

10:58:48 8 2016 with respect to the 750; correct?

10:58:52 9 A. They're based on the initial CFD analysis.

10:58:54 10 I don't know if they were completed by January of

10:58:57 11 2016, but they are based on the initial CFD analysis.

10:59:00 12 Q. Okay. And you agree with me there's nothing

10:59:09 13 in your report that identifies the equations that you

10:59:12 14 used with respect to your analysis of the problem.

10:59:17 15 A. I agree.

10:59:18 16 Q. Okay. Now I asked you what the time step

10:59:29 17 was, and I know you looked through your report

10:59:31 18 somewhere. Did you see anything about the time step

10:59:33 19 that was used?

10:59:34 20 A. The only thing I saw was the statement that

10:59:36 21 the results at other time steps lead to the same

10:59:39 22 conclusions.

10:59:40 23 Q. Is -- Is a time step, is that a -- is it a

10:59:42 24 constant time between, like, 263 and 264?

10:59:48 25 A. Yes.

10:59:50 1 Q. And when you're talking about a time step  
10:59:52 2 are you like running it every second, every two  
10:59:55 3 seconds, every five seconds?  
10:59:57 4 A. You -- It's like that, but you use -- you  
11:00:00 5 can use different time steps during your calculation.  
11:00:06 6 So, for example, you might want to use small time  
11:00:10 7 steps initially to get things going, and then you  
11:00:14 8 might use larger time steps, let's say, once you get  
11:00:18 9 to quasi steady and you want to go out further in time  
11:00:21 10 just to verify. So you can change the time step over  
11:00:24 11 ti -- over -- over -- during the calculation. But  
11:00:26 12 unless you do that, the time step is the same between  
11:00:29 13 each sequential time.  
11:00:32 14 Q. So is it a second, a fraction of a second?  
11:00:35 15 A. It would be a fraction of a second.  
11:00:37 16 Q. And did you ever change the time steps?  
11:00:38 17 A. Yes.  
11:00:38 18 Q. At what point?  
11:00:42 19 A. What do you mean by "at what point" ?  
11:00:44 20 Q. Like when did --  
11:00:45 21 Did you change the time step between 1 and  
11:00:48 22 264?  
11:00:49 23 A. I don't recall.  
11:00:51 24 Q. Where would that information be?  
11:00:59 25 A. I don't know if I recorded that. I don't

11:01:02 1 recall recording when I changed -- when or if I  
11:01:06 2 changed time steps.

11:01:07 3 Q. So you don't know even if you changed the  
11:01:09 4 time step.

11:01:17 5 A. I --

11:01:18 6 You know, thinking back, I do recall  
11:01:20 7 changing the time step, but I don't recall when.

11:01:37 8 Q. You do understand that all the opinions you  
11:01:39 9 intend to offer in this case had to be disclosed to  
11:01:42 10 the plaintiff by June 2nd, 2017.

11:01:45 11 MR. GOSS: Object to form, foundation.

11:01:48 12 Q. Were you aware of a deadline for your expert  
11:01:50 13 opinion in this case? Your report?

11:01:52 14 A. Yes, I was.

11:01:53 15 Q. Okay. And the deadline was June 2nd, 2017?

11:01:57 16 A. That sounds --

11:01:58 17 Q. Okay.

11:01:59 18 A. -- right.

11:02:00 19 Q. And you prepared the report yourself?

11:02:02 20 A. Yes.

11:02:03 21 Q. Okay. Did anyone provide any edits to the  
11:02:05 22 report?

11:02:05 23 A. Yes.

11:02:06 24 Q. Who?

11:02:08 25 A. Counsel would have provided typographical

11:02:11 1 edits; commas, periods. Nothing substantive, nothing  
11:02:17 2 that would change the conclusions or any substance of  
11:02:21 3 the report.

11:02:22 4 Q. Any of your colleagues look at it and offer  
11:02:24 5 any edits?

11:02:27 6 A. No.

11:02:27 7 Q. Okay. When was the journal article  
11:02:34 8 submitted?

11:02:44 9 A. I would estimate -- estimate April or May.

11:02:46 10 Q. Of this year?

11:02:47 11 A. Yes.

11:02:47 12 Q. Okay. Did you put the time step in the  
11:03:02 13 journal?

11:03:05 14 A. I would have to look. I don't know.

11:03:07 15 Q. Okay. If you do change the time step during  
11:03:13 16 a -- a run, is that something that you would disclose  
11:03:17 17 in the methodology of a journal paper?

11:03:22 18 A. The choice of time step is important to  
11:03:24 19 disclose, and its bearing on accuracy, but whether or  
11:03:28 20 not you change it may or may not be important.

11:03:32 21 Q. So you definitely would have disclosed,  
11:03:34 22 like, the -- that the -- Strike that.

11:03:36 23 The time step is an important piece of  
11:03:46 24 information that is usually submitted as a part of a  
11:03:51 25 CFD analysis in a scientifical -- scientific research

11:03:53 1 report for publication.

11:03:54 2 A. Yes.

11:03:56 3 Q. Okay. Because you would need the time step

11:03:59 4 to reproduce the results.

11:04:02 5 A. Correct.

11:04:03 6 Q. Okay. Do you agree with me that there is a

11:04:11 7 lot more information in your journal article than is

11:04:14 8 contained in your expert report? Scientific

11:04:18 9 information?

11:04:25 10 A. No.

11:04:26 11 Q. "No"?

11:04:27 12 A. No.

11:04:27 13 Q. Okay. Without the time step can I reproduce  
11:04:40 14 your results?

11:04:41 15 A. Yes.

11:04:42 16 Q. But you just told me it was very important  
11:04:43 17 to reproduce the results.

11:04:46 18 A. Correct.

11:04:47 19 Q. So without it and it's an important piece of  
11:04:51 20 information to reproduce results, how would I  
11:04:53 21 reproduce your results without a time step?

11:04:56 22 A. And actually let me clarify my earlier  
11:05:01 23 answer.

11:05:02 24 Provided that your time step is sufficiently  
11:05:04 25 small and that it allows you to reach quasi-steady

11:05:08 1 results, you would be able to reproduce these results.

11:05:15 2 Q. Okay. But if I wanted to -- I guess for --

11:05:22 3 to create file 264 again, I would need the time step

11:05:27 4 that you used; correct?

11:05:30 5 A. No.

11:05:32 6 Q. Well how would I know that 264 correlates to

11:05:35 7 the time step you used without knowing your time step?

11:05:38 8 A. Well first of all, the TRN file that I

11:05:41 9 provided has my time steps. Okay?

11:05:44 10 Q. Okay.

11:05:45 11 A. Secondly, the number 264 isn't important by

11:05:49 12 itself. What's important -- And this is the same with

11:05:53 13 Dr. Elghobashi's work. What's important is that you

11:05:59 14 run the results long enough so that there's not

11:06:01 15 meaningful change. And so you could repre --

11:06:03 16 reproduce the quasi-steady results without knowing the

11:06:07 17 time step that I used.

11:06:08 18 Q. And I understand what you're saying, but my

11:06:10 19 question's a little bit more specific, okay?

11:06:12 20 I assume that every single time step, okay,

11:06:19 21 has numbers in it that -- that identify the results of

11:06:25 22 the calculations for a different part of the mesh;

11:06:30 23 correct?

11:06:30 24 A. Correct.

11:06:31 25 Q. Okay. So if I wanted to run a CFD model and

11:06:38 1 obtain the same numbers in the 264th time step, I  
11:06:47 2 would need to know what time step you used; correct?  
11:06:54 3 A. That is correct, but that's not relevant.  
11:07:00 4 Q. I understand that. It might not be  
11:07:02 5 relevant, but my statement is correct.  
11:07:04 6 A. Yes.  
11:07:05 7 Q. Okay. And I would have to know, like, where  
11:07:11 8 you started kind of; right?  
11:07:15 9 A. Correct.  
11:07:18 10 Q. I mean, is that called the boundary  
11:07:19 11 conditions or is it called something else where you  
11:07:21 12 start?  
11:07:22 13 A. Where you start is called the initial  
11:07:24 14 condition.  
11:07:24 15 Q. Okay. Are the initial conditions anywhere  
11:07:27 16 in your report?  
11:07:29 17 A. No.  
11:07:29 18 Q. Okay. Do you have it in any type of your  
11:07:32 19 notes?  
11:07:33 20 A. No.  
11:07:33 21 Q. Is it anywhere that I could obtain it  
11:07:35 22 sitting here today?  
11:07:36 23 A. No. And it's not relevant.  
11:07:38 24 Q. Okay. I understand that you say it's not  
11:07:40 25 relevant, but that's kind of a legal term. So let's

11:07:46 1 stick the relevancy objections to your counsel and  
11:07:49 2 just answer my questions for me.

11:07:50 3 MR. GOSS: Well I think "relevance" has a  
11:07:51 4 meaning outside of the law, and if that's the way  
11:07:54 5 he's using it, then --

11:07:55 6 MR. ASSAAD: Fair enough.

11:07:56 7 MR. GOSS: -- let him use it.

11:08:03 8 BY MR. ASSAAD:

11:08:03 9 Q. But I would need those initial conditions to  
11:08:07 10 do the exact same thing that you did to get the  
11:08:10 11 results that are obtained in the TRN file that you've  
11:08:13 12 provided; correct?

11:08:15 13 A. That is a correct statement.

11:08:17 14 Q. Okay. And I'd also have to know whether or  
11:08:20 15 not you changed the time step between the initial  
11:08:25 16 conditions and time step 264; correct?

11:08:29 17 A. Correct.

11:08:30 18 Q. Okay. Otherwise, without those data -- that  
11:08:38 19 data, it would be impossible for me to replicate the  
11:08:44 20 results you found in your 264 TRN file; correct?

11:08:47 21 A. I disagree.

11:08:48 22 Q. How would I replicate and get the exact same  
11:08:52 23 numbers -- I'm not talking about your judgment -- I'm  
11:08:55 24 talking about the exact same calculated numbers in the  
11:08:59 25 264 TRN file, if I don't have the initial conditions?

11:09:05 1 A. You're using the word "replicate" in a way  
11:09:08 2 that's not the way it's used in our field. To  
11:09:14 3 replicate, and I mentioned this before, "replicate"  
11:09:19 4 doesn't mean to do the exact same thing with the exact  
11:09:22 5 same methodology, but it's to come up with the same  
11:09:27 6 results and conclusions. You are able -- Anyone is  
11:09:32 7 able to replicate my work simply from that TRN file.  
11:09:38 8 Now that doesn't mean that at the 264th time step they  
11:09:43 9 will have the exact same numbers, but it means that if  
11:09:47 10 they do the problem right they will come to the exact  
11:09:49 11 same conclusions.

11:09:50 12 Q. And I understand that, and I understand  
11:09:52 13 exactly what you're saying, sir. And I -- And I know  
11:09:56 14 you think some of my questions don't mean anything or  
11:09:59 15 are not relevant, but what I'm really just trying to  
11:10:02 16 find out is this. I cannot replicate the same numbers  
11:10:05 17 in 264 unless I have the initial -- the initial  
11:10:09 18 conditions; correct?

11:10:12 19 A. That is correct.

11:10:13 20 Q. Okay.

11:10:13 21 A. And I just want to correct your  
11:10:15 22 interpretation of my answer.

11:10:17 23 Can I ask for your answer to be -- your  
11:10:21 24 response to be read back?

11:10:23 25 Q. Well you can talk to your counsel and he

11:10:26 1 could ask -- he can correct anything later on when he  
11:10:27 2 has a chance to ask.

11:10:28 3 A. Okay. Well then I'll do it from memory.  
11:10:32 4 It's not that I disagree with your question,  
11:10:43 5 it's that you're using the word "replicate" in a way  
11:10:47 6 that is not used in this field. You're -- Maybe  
11:10:52 7 you're using "replicate" with a legal meaning, but  
11:10:55 8 that's not -- when we talk about can you replicate  
11:10:58 9 someone's study we are not talking -- we're not using  
11:11:01 10 the word replicate as you've done. That's my  
11:11:03 11 clarification.

11:11:03 12 Q. And I understand that, because there could  
11:11:05 13 be a different methodology or a different initial  
11:11:07 14 conditions; correct?

11:11:09 15 A. Correct.

11:11:09 16 Q. But my question is more just simple math.  
11:11:12 17 To get the calculated numbers in the 264  
11:11:16 18 TRN, I would need to know what the initial conditions  
11:11:18 19 are; correct?

11:11:19 20 A. That is correct.

11:11:20 21 Q. Okay. Now for the 254 TRN file did you use  
11:11:38 22 RANS or LES?

11:11:40 23 A. I used LES, which is Large-Eddy Simulation.

11:11:45 24 Q. Okay. Did you ever use RANS initially?

11:11:48 25 A. Yes.

11:11:49 1 Q. And was that to create your initial  
11:11:51 2 conditions?  
11:11:52 3 A. Yes.  
11:11:53 4 Q. Okay. What was showed in Science Day, was  
11:12:00 5 that a RANS model or an LES model?  
11:12:03 6 A. LES.  
11:12:03 7 Q. Okay. And you ran RANS once, correct, to  
11:12:06 8 get your initial conditions?  
11:12:07 9 A. I believe that's true.  
11:12:09 10 Q. And RANS is steady state?  
11:12:12 11 A. RANS does not have to be steady state.  
11:12:14 12 Q. Did you run it steady state?  
11:12:16 13 A. I would have run it steady state.  
11:12:18 14 Q. Okay. And my understanding is that you used  
11:12:22 15 the, according to your report, the Boussinesq  
11:12:27 16 approximation?  
11:12:27 17 A. That's right. And I'm going to try to spell  
11:12:29 18 that.  
11:12:29 19 Q. We can -- We can give the spellings later  
11:12:31 20 on to her. I don't want to waste time with spelling.  
11:12:33 21 A. Thank you.  
11:12:34 22 Q. Okay. And on the --  
11:12:35 23 And just so I understand, did you use RANS  
11:12:37 24 or LES for the 2540?  
11:12:40 25 A. LES.

11:12:40 1 Q. Okay. And you also used the Boussinesq for  
11:12:44 2 the 2540?

11:12:45 3 A. Correct.

11:12:50 4 Q. And so you received a geometry, a CAD file  
11:12:56 5 from the lawyers for 3M.

11:12:59 6 A. Correct.

11:13:00 7 Q. Okay. And those are not the lawyers of  
11:13:01 8 Blackwell Burke, but Greenberg Traurig; correct?

11:13:05 9 A. Correct.

11:13:05 10 Q. Were you aware why -- why Greenberg Traurig  
11:13:08 11 was not -- no longer attorneys for 3M?

11:13:13 12 A. No.

11:13:13 13 Q. Okay. And you don't know who created the  
11:13:15 14 geometry; correct?

11:13:17 15 A. Correct.

11:13:19 16 Q. Do you know what software they used?

11:13:22 17 A. No.

11:13:23 18 Q. Okay. And I take it you just imported it  
11:13:26 19 into whatever system that you use.

11:13:28 20 A. Correct.

11:13:29 21 Q. And that would be ANSYS?

11:13:30 22 A. Correct.

11:13:31 23 Q. ANSYS CFX or ANSYS Fluent?

11:13:35 24 A. We used ANSYS CFX.

11:13:38 25 Q. Okay. And did you change the geometry in

11:13:52 1 any way?

11:13:53 2 A. Yes.

11:13:54 3 Q. How did you change the geometry?

11:13:57 4 A. I omitted small and insignificant objects, I

11:14:03 5 don't recall which ones. But as an example, let's say

11:14:07 6 I want to simulate the airflow in this room. There

11:14:11 7 are many small features which may not matter, like the

11:14:15 8 doorknob, the handle on the cup -- the cupboard over

11:14:25 9 there. Those features that are small that don't

11:14:28 10 affect the flow I would have -- I removed some of

11:14:31 11 them.

11:14:32 12 Q. Okay. And that'd just be a judgment call

11:14:35 13 what you believe would affect or not affect the

11:14:37 14 airflow.

11:14:38 15 A. That is correct.

11:14:38 16 Q. Okay. Based on your education, training and

11:14:41 17 experience.

11:14:42 18 A. That is correct.

11:14:43 19 Q. Okay. And did the geometry already contain

11:14:49 20 a grid or a mesh?

11:14:51 21 A. No.

11:14:52 22 Q. Okay. Is a grid and mesh the same thing?

11:14:56 23 A. Yes.

11:14:57 24 Q. Okay. Now what program was used to create

11:15:08 25 the mesh?

11:15:11 1 A. The ANSYS mesher.

11:15:18 2 Q. And what shapes were used to create the

11:15:25 3 mesh?

11:15:27 4 A. The vast majority, perhaps all of the shapes

11:15:30 5 were tetrahedral.

11:15:33 6 Q. Okay.

11:15:33 7 A. Pyramid -- Pyramid-like shapes.

11:15:35 8 Q. Okay. Four-sided trian --

11:15:37 9 Four sides of triangles; correct?

11:15:38 10 A. Or five sides.

11:15:39 11 Q. Or five sides. I'm sorry. You're right,

11:15:42 12 five sides.

11:15:43 13 A. Well it's four or five, it's a combination.

11:15:46 14 Q. Okay.

11:15:46 15 A. Pyramids and tetrahedrons are two

11:15:49 16 complimentary shapes; one of them has five sides, one

11:15:52 17 has four sides.

11:15:53 18 Q. Okay. So tetrahedral could either be four

11:15:56 19 or five sides?

11:15:57 20 A. No. We use the term tetrahedral for four

11:16:00 21 sided, and that's what "tetra" comes from. We use

11:16:05 22 pyramidal or pyramid elements in our field generally

11:16:10 23 refers to five-sided.

11:16:11 24 Q. Okay. So you believe that all the mesh

11:16:15 25 shapes were tetrahedral?

11:16:18 1 A. Or pyra --  
11:16:21 2 Or pyramids.  
11:16:24 3 Q. Okay. Is that something that you've written  
11:16:26 4 down?  
11:16:26 5 A. No.  
11:16:27 6 Q. How would I find that out?  
11:16:29 7 A. From the TRN file.  
11:16:30 8 Q. Okay. And what --  
11:16:43 9 Do you know what CFX solves for; does it  
11:16:45 10 solve for the different shapes, or does it kind of say  
11:16:48 11 it's all one shape?  
11:16:50 12 A. I don't quite know how to interpret your  
11:16:52 13 question.  
11:16:56 14 Q. Well did you use any --  
11:16:57 15 I guess what's the term polyhedra with  
11:17:01 16 respect to CFX; does that mean anything?  
11:17:05 17 A. Polyhedra would refer to a multi-sided  
11:17:09 18 element.  
11:17:09 19 Q. Okay. Does CFX solve for polyhedras?  
11:17:18 20 A. Well polyhedra means a multi-sided object.  
11:17:21 21 Q. Okay.  
11:17:21 22 A. CFX will solve for brick-shaped elements,  
11:17:24 23 which have eight sides; it will solve for hexahedras,  
11:17:30 24 which have six sides. They can have -- It'll solve  
11:17:33 25 for wedge elements which have five; pyramid elements

11:17:37 1 which have five; and tetrahedras, which have five.

11:17:40 2 Q. Okay.

11:17:41 3 A. Or, I'm sorry, four.

11:17:43 4 Q. Okay. And I know you -- in your journal

11:17:52 5 article you looked at the 505 as well?

11:17:54 6 A. Yes.

11:17:55 7 Q. And did you use the same geometry in the 505

11:17:57 8 as you did with the 750?

11:17:59 9 A. Yes.

11:18:00 10 Q. Okay. So I assume you still have the

11:18:03 11 geometry someplace.

11:18:05 12 A. That's correct.

11:18:07 13 Q. Did you pull that geometry from the 505 --

11:18:10 14 that you used in the 505 from the TRN file, the 264?

11:18:14 15 A. Yes.

11:18:15 16 Q. So you don't have the original geometry file

11:18:18 17 that was given to you by the lawyers for 3M.

11:18:23 18 A. I don't know. I may. I would have to look.

11:18:36 19 Q. Okay. So you said something about ANSYS

11:18:39 20 mesher. Is that the only meshing program that you

11:18:44 21 could use in ANSYS?

11:18:45 22 A. No.

11:18:45 23 Q. Why did you decide to use ANSYS mesher?

11:18:48 24 A. Well the meshing program in ANSYS actually

11:18:51 25 has many different meshers.

1 Q. Okay.

11:18:53 2 A. So I used the meshers contained in the ANSYS

11:18:56 3 software, but there are other meshers I could have

11:18:58 4 used.

11:18:58 5 Q. Does it create its own file after it's done?

11:19:01 6 A. Yes.

11:19:01 7 Q. Where is that file?

11:19:02 8 A. It's --

11:19:03 9 The mesh is contained within the TRN.

11:19:05 10 Q. But does it create a separate file after you

11:19:07 11 mesh?

11:19:07 12 A. It would create a separate file after the

11:19:09 13 mesh.

11:19:10 14 Q. And where is that file?

11:19:12 15 A. I don't think I have it because it's

11:19:13 16 contained within the TRN.

11:19:15 17 Q. I understand that, but you run the mesh and

11:19:17 18 I -- you just said it creates its own separate file;

11:19:20 19 correct?

11:19:20 20 A. That's right.

11:19:21 21 Q. That's before you probably run any of the

11:19:22 22 calculations; correct?

11:19:23 23 A. That's correct.

11:19:24 24 Q. Did you delete that meshing file?

11:19:25 25 A. I would have to look to see if I have it,

11:19:27 1 but once you have the TRN file you don't nee -- you  
11:19:30 2 don't need the mesh file, so there's no reason to keep  
11:19:32 3 it.

11:19:33 4 Q. Okay. Okay. So whether or not you kept it  
11:19:35 5 or not is irrelevant because you have it in the TRN  
11:19:38 6 file.

11:19:38 7 A. That is correct.

11:19:39 8 Q. Okay. Does CFX put out any other files  
11:19:44 9 besides a TRN file?

11:19:47 10 A. Yes.

11:19:48 11 Q. What files?

11:19:49 12 A. It puts out an output file which is just a  
11:19:52 13 script of what you've done, which is the same as --  
11:19:55 14 it's all contained in the TRN. And it puts out what's  
11:19:58 15 called a RES file, which is the results, which is also  
11:20:02 16 the same as the TRN.

11:20:05 17 Q. Okay. Do you have those files?

11:20:06 18 A. No. Well I may have the output file, which  
11:20:09 19 is a script file, but the results file are the same as  
11:20:12 20 the TRN.

11:20:13 21 Q. Okay. So what's the output file, does that  
11:20:15 22 contain your initial conditions?

11:20:18 23 A. It -- I don't know.

11:20:25 24 Q. So it may?

11:20:26 25 A. Well, I mean, it -- it does -- it --

11:20:29 1 Well let me say this. It does not contain  
11:20:31 2 the initial conditions. It's a script file. It's  
11:20:33 3 just writing of the setup of your problem.

11:20:36 4 Q. But wouldn't the setup have the initial  
11:20:38 5 conditions?

11:20:39 6 A. No, because it's just the script. So, for  
11:20:43 7 example, it says you're using air, you're using the  
11:20:47 8 LES method, your density is this, your velocity is  
11:20:50 9 this.

11:20:51 10 Q. Okay.

11:20:51 11 A. So it's information written to a script, but  
11:20:53 12 it's not data.

11:20:54 13 Q. Okay. And you said there was a results file  
11:20:57 14 but you don't have that any more; correct?

11:20:59 15 A. Correct, because it's contained within the  
11:21:01 16 TRN.

11:21:01 17 Q. Okay. Any other files?

11:21:06 18 A. Not that I can think of.

11:21:10 19 Q. I mean, does CFX put a CFX file out?

11:21:14 20 A. Yeah. Actually there are two more files,  
11:21:16 21 thanks for reminding me.

11:21:18 22 There could be a CFX file, and what's called  
11:21:20 23 a DEF file, definition file. Both of those are  
11:21:23 24 contained within the TRN.

11:21:25 25 Q. Okay. But they're al -- they're also

11:21:26 1 separate files as well.

11:21:27 2 A. That's correct.

11:21:28 3 Q. Do you still have those files, or have they

11:21:30 4 been deleted?

11:21:31 5 A. I don't believe I still have them because

11:21:33 6 they're contained within the TRN.

11:21:35 7 Q. And are these files on your personal

11:21:37 8 computer, or on a server in St. Thomas?

11:21:40 9 A. They would be on a computer at St. Thomas.

11:21:42 10 Q. On the server?

11:21:44 11 A. Well they're on a desktop.

11:21:46 12 Q. Okay. And what computer did you use to run

11:22:07 13 the CFX, or the -- the model?

11:22:10 14 A. I used a multicore desktop machine.

11:22:13 15 Q. How many cores?

11:22:15 16 A. I recall 16.

11:22:17 17 Q. Sixteen cores?

11:22:17 18 A. Yep.

11:22:20 19 Q. Did you consider using a supercomputer?

11:22:23 20 A. No.

11:22:24 21 Q. What about a computer at the University of

11:22:26 22 Minnesota?

11:22:27 23 A. I did not consider that.

11:22:28 24 Q. So you never used a computer at the

11:22:30 25 University of Minnesota?

11:22:31 1 A. The -- I have used computers at the  
11:22:33 2 University of Minnesota.

11:22:34 3 Q. I mean for this. For this.

11:22:35 4 A. For this I did not.

11:22:36 5 Q. Okay.

11:22:49 6 (Abraham Exhibit 6 marked for  
7 identification.)

8 BY MR. ASSAAD:

11:22:58 9 Q. What's been marked as Exhibit 6 is a  
11:22:59 10 document that was produced to us during the first  
11:23:01 11 subpoena issued to you, titled Abraham 00002 regarding  
11:23:10 12 your job information.

11:23:10 13 Do you recall this document?

11:23:11 14 A. Yes.

11:23:12 15 Q. What is this document?

11:23:15 16 A. This document lists the -- it's information  
11:23:20 17 about the run and the subdivision of elements or --  
11:23:26 18 the subdivision of the problem to processors or to  
11:23:29 19 cores.

11:23:31 20 Q. Engineering Sparrow, what's that?

11:23:33 21 A. It's a name of a computer.

11:23:35 22 Q. That you use at St. Thomas?

11:23:36 23 A. Correct.

11:23:37 24 Q. And the reason why I'm confused is because  
11:23:39 25 you trained under Sparrow; correct?

11:23:41 1 A. That's correct.

11:23:41 2 Q. Okay. So this is not his computer?

11:23:43 3 A. That is correct.

11:23:43 4 Q. Okay. So you used no resources from the

11:23:46 5 University of Minnesota.

11:23:47 6 A. Correct.

11:23:48 7 Q. Okay. And where it says "mesh," are these

11:23:51 8 mesh or nodes? Or do you know what that even is?

11:23:58 9 A. I know what that is.

11:23:59 10 Q. What is it?

11:24:03 11 A. When you want to solve a problem, let's say

11:24:06 12 fluid flow in this room, the problem is very complex

11:24:13 13 and the mathematics is very difficult so what is done

11:24:16 14 is you subdivide the room into a number of --

11:24:21 15 Q. Parts?

11:24:22 16 A. I'd say parts, and there are these

11:24:24 17 tetrahedra, pyramid, hexahedra, these elements that we

11:24:29 18 were talking about.

11:24:29 19 Q. Umm-hmm?

11:24:30 20 A. Those are cells. We call that the mesh.

11:24:34 21 At the intersection of those cells where two

11:24:36 22 come together we call that a node. And so cells and

11:24:41 23 nodes, or mesh and nodes are used together.

11:24:46 24 Q. So this isn't the mesh size, this is

11:24:48 25 probably the nodes size?

11:24:50 1 A. I don't know if these numbers refer to the  
11:24:53 2 number of elements or the number of nodes.

11:24:56 3 Q. Well I add these up and they're roughly  
11:24:58 4 between 1.8 to 1.9 million. I assume your mesh was  
11:25:03 5 larger than 1.9 million.

11:25:05 6 A. Correct.

11:25:06 7 Q. Okay. Do you know how many nodes you had?

11:25:10 8 A. The re --

11:25:11 9 All the results contained here are about 8.1  
11:25:14 10 million elements. I don't know the number of nodes,  
11:25:18 11 but it would be approximately that number.

11:25:20 12 Q. The same --

11:25:21 13 The nodes equal elements?

11:25:23 14 A. No.

11:25:24 15 Q. Close to the elements?

11:25:25 16 A. Close.

11:25:26 17 Q. Okay. Then how would I know this 8.1  
11:25:32 18 million?

11:25:34 19 A. From the TRN file.

11:25:41 20 Q. Did you have another --

11:25:45 21 Do you have another one of these Job  
11:25:47 22 Information tables for the RANS model that you ran?

11:25:55 23 A. I don't believe so. I can go look when I  
11:25:57 24 get to my computer, but I don't recall. I don't  
11:25:59 25 believe so.

11:26:08 1 Q. And, I'm sorry, you said you had 16 cores?

11:26:10 2 A. Correct.

11:26:12 3 Q. Is it a double or single precision?

11:26:16 4 A. Well the cores aren't double precision,

11:26:18 5 they're single precision.

11:26:22 6 Q. Did you monitor the solutions as they

11:26:24 7 solved?

11:26:25 8 A. Yes.

11:26:26 9 Q. How long did it take to solve?

11:26:30 10 A. I recall something like 40 days.

11:26:34 11 Q. Forty days?

11:26:34 12 A. Correct.

11:26:35 13 Q. Nonstop running?

11:26:36 14 A. Correct.

11:26:48 15 Q. So when did you start the solution? Would

11:26:51 16 it be this date, November 18th, 2015?

11:26:56 17 A. Well certainly --

11:26:59 18 It appears that that is the date.

11:27:01 19 Q. Okay. So that's the start time.

11:27:03 20 A. Yes.

11:27:04 21 Q. Okay. So you would have not gotten the

11:27:07 22 solution till the middle of December?

11:27:29 23 A. You know, I think I -- I'm struggling with

11:27:31 24 memory. I'm trying to remember the details of the

11:27:34 25 length. If the run starting on November 18th was the

11:27:46 1 beginning of the run, and I recall 40 days, then yes,  
11:27:50 2 the result would have been obtained aft -- 40 days  
11:27:54 3 later.

11:27:56 4 But I don't know where in the calculation  
11:27:58 5 this run -- this start run corresponds to. So it  
11:28:03 6 could have been the initial start, it could have been  
11:28:07 7 after a hundred time steps, it could have been after  
11:28:11 8 200, so I -- I can't tell you, sitting here, what time  
11:28:14 9 step this start run corresponds to. I just don't  
11:28:17 10 recall.

11:28:17 11 Q. So this -- this is performed for every time  
11:28:19 12 step?

11:28:21 13 A. No.

11:28:24 14 Q. Okay. So sitting here today, you're not  
11:28:26 15 sure of when you started the -- the run.

11:28:30 16 A. Correct.

11:28:31 17 Q. Okay. The fact that the contract was  
11:28:35 18 signed, or the proposal with St. Thomas and 3M was  
11:28:38 19 October 17th, 2015, does that give you -- does that  
11:28:43 20 refresh your recollection as how long it took you to,  
11:28:46 21 I guess, import the geometry, do the mesh or do  
11:28:51 22 whatever you had to do before you started the run?

11:28:53 23 A. No.

11:28:54 24 Q. How long did it take you to create the mesh?

11:28:58 25 A. I don't recall.

11:29:00 1 Q. Was it a day, an hour?

11:29:02 2 A. It would have been more than an hour, likely

11:29:04 3 more than a day.

11:29:06 4 Q. Okay. By the way, do you have authority to

11:29:15 5 sign contracts between St. Thomas and third parties?

11:29:22 6 A. I am one of the signers.

11:29:25 7 Q. And who is the other signer?

11:29:26 8 A. There are other folks in the administration.

11:29:28 9 I think the Dean would sign, and then there may be

11:29:36 10 someone else.

11:29:37 11 Q. Okay. I take it that you've reviewed Dr.

11:30:10 12 Settles' report; correct?

11:30:11 13 A. Yes.

11:30:12 14 Q. And you reviewed Dr. Kuehn's report from

11:30:17 15 University of Minnesota.

11:30:18 16 A. Yes.

11:30:18 17 Q. Have you ever had any classes with Dr.

11:30:20 18 Kuehn?

11:30:21 19 A. Yes.

11:30:22 20 Q. When you were an undergrad?

11:30:25 21 A. That's correct.

11:30:26 22 Q. What class?

11:30:26 23 A. It -- And I think I was an undergrad, it's

11:30:29 24 possible I was studying my mas -- getting my master's

11:30:32 25 degree. But I recall taking a class from him related

11:30:36 1 to heating, ventilation and air conditioning.

11:30:40 2 Q. Okay. Did you rely on Dr. Settles' report

11:30:49 3 for any information?

11:30:50 4 A. No.

11:30:51 5 Q. Did you rely on Dr. Kuehn's report for any

11:30:53 6 information?

11:30:53 7 A. I relied on Dr. Kuehn's report to confirm my

11:30:56 8 results.

11:30:57 9 Q. And what did you look at Dr. Kuehn's report?

11:31:02 10 A. His velocity and temperature measurements.

11:31:04 11 Q. Okay. Did you read his deposition?

11:31:05 12 A. Yes.

11:31:06 13 Q. Okay. The entire dep --

11:31:08 14 You read the entire deposition?

11:31:09 15 A. Yes.

11:31:10 16 Q. Did you read Dr. Settles' deposition?

11:31:12 17 A. Yes.

11:31:15 18 Q. Did you read any other depositions?

11:31:17 19 A. Yes.

11:31:17 20 Q. What other depositions did you read?

11:31:20 21 A. I read all of the depositions from the

11:31:24 22 plaintiff's side.

11:31:27 23 Q. Plaintiffs' experts, or plaintiff's side?

11:31:29 24 A. Plaintiffs' experts.

11:31:30 25 Q. Okay.

11:31:30 1 A. Okay.

11:31:31 2 Q. So that would have been Dr. Elghobashi?

11:31:33 3 A. That's right. I read his.

11:31:34 4 Q. Okay. Doctor -- Or Dan Koenigshofer?

11:31:38 5 A. Yes.

11:31:39 6 Q. Michael Buck?

11:31:41 7 A. I -- I'm struggling to go through -- to

11:31:44 8 remember the names, but there were perha -- maybe make

11:31:48 9 this easier. There are maybe eight or nine or so

11:31:50 10 expert depositions that I was provided, and I read all

11:31:53 11 of them. I recall -- I think I recall the name

11:31:56 12 Michael Buck.

11:31:57 13 Q. Okay.

11:31:58 14 A. Certainly Dan K.

11:32:00 15 Q. Umm-hmm.

11:32:01 16 A. Certainly Said Elghobashi.

11:32:04 17 Q. Okay. Well I will represent to you that the

11:32:05 18 plaintiffs only have seven experts, and not all of

11:32:08 19 them have been deposed. So -- So are there -- are you

11:32:14 20 mixing expert reports and depositions?

11:32:22 21 A. That's actually possible. Maybe -- I think

11:32:24 22 I am mixing expert reports and depositions.

11:32:26 23 Q. Okay.

11:32:27 24 A. Thank you for correcting me.

11:32:28 25 Q. So what depositions have you read?

11:32:29 1 You read Dr. Settles and Dr. Kuehn; correct?

11:32:33 2 A. That's correct.

11:32:34 3 Q. You've read Dr. Elghobashi; correct?

11:32:35 4 A. Correct.

11:32:36 5 Q. Have you read Michael Buck?

11:32:38 6 A. No.

11:32:39 7 Q. Have you read Dr. -- or Dan Koenigshofer?

11:32:42 8 A. The only deposition -- And thank you so much

11:32:45 9 for correcting me.

11:32:45 10 The only deposition on the plaintiff's side

11:32:47 11 that I've read is Elghobashi.

11:32:49 12 Q. Okay. So you've seen all the reports of

11:32:52 13 plaintiffs' experts, you just have only read the

11:32:54 14 Elghobashi deposition.

11:32:55 15 A. That is correct.

11:32:56 16 Q. Have you received any other depositions of

11:32:57 17 plaintiffs' experts?

11:33:02 18 A. No.

11:33:03 19 Q. Okay. Have you read the depositions of

11:33:05 20 defense experts?

11:33:08 21 A. Just the --

11:33:10 22 Just Settles and Kuehn.

11:33:15 23 Q. Okay. And Kuehn is K-U-E-H-N, that Kuehn;

11:33:27 24 correct?

11:33:27 25 A. Correct.

11:33:28 1 Q. Okay. Have you read Michael Keen's  
11:33:33 2 deposition, Keen from Cali -- or from Canada?  
11:33:37 3 A. No.  
11:33:37 4 Q. Okay. Have you reviewed any expert reports  
11:33:40 5 by the defense?  
11:33:44 6 A. I don't think so.  
11:33:45 7 Q. Well you've seen Gary Settles' report;  
11:33:47 8 correct?  
11:33:49 9 A. Correct.  
11:33:49 10 Q. Okay. And you've -- you've seen Dr. Kuehn's  
11:33:51 11 report.  
11:33:52 12 A. That is correct.  
11:33:54 13 Q. Okay.  
11:33:55 14 MR. GOSS: Do you mean American Kuehn?  
11:33:57 15 MR. ASSAAD: American Kuehn.  
11:33:58 16 MR. GOSS: Thank you.  
11:33:59 17 Q. Okay.  
11:34:00 18 A. Correct.  
11:34:00 19 Q. Have you seen any other of defense expert  
11:34:02 20 reports?  
11:34:07 21 A. I have defense expert reports. I have only  
11:34:11 22 read the two that we just mentioned.  
11:34:14 23 Q. So you haven't read the report -- the expert  
11:34:16 24 report of Jim Ho.  
11:34:18 25 A. Correct.

11:34:19 1 Q. You haven't read the report of Michael Keen  
11:34:22 2 from Canada.  
11:34:23 3 A. Correct.  
11:34:24 4 Q. You haven't read the report of Dr. Mont.  
11:34:26 5 A. Correct.  
11:34:27 6 Q. You haven't read the report of Dr. Holford?  
11:34:32 7 Holford.  
11:34:32 8 A. Correct.  
11:34:33 9 Q. You haven't read the report of Dr. Borak.  
11:34:36 10 A. Correct.  
11:34:37 11 Q. You haven't read the report of Dr. Wenzel;  
11:34:39 12 correct?  
11:34:39 13 A. Correct.  
11:34:40 14 Q. And you haven't read the expert report of  
11:34:49 15 Dr. Lampotang; correct?  
11:34:52 16 A. Correct.  
11:34:52 17 Q. You haven't read the report of Dr.  
11:34:54 18 Hannenberg; correct?  
11:34:57 19 A. Correct.  
11:35:04 20 Q. Have you read the deposition of Al Van  
11:35:07 21 Duren?  
11:35:08 22 A. I have read a deposition of Al Van Duren.  
11:35:11 23 Q. Which one; do you recall?  
11:35:12 24 A. It was in maybe September 2015. So I have  
11:35:20 25 read a deposition around that time.

11:35:21 1 Q. So you read the deposition that was done in  
11:35:23 2 the Walton case, or the Johnson case.  
11:35:25 3 A. I don't know about the cases.  
11:35:28 4 Q. Okay.  
11:35:28 5 A. I read a deposition from Al Van Duren around  
11:35:30 6 September 2015.  
11:35:32 7 Q. Okay. Any other depositions you've read of  
11:35:34 8 fact witnesses?  
11:35:35 9 A. Yes.  
11:35:36 10 Q. Who?  
11:35:38 11 A. Gary Hansen.  
11:35:40 12 Q. Okay.  
11:35:40 13 A. And Winston Tan.  
11:35:42 14 Q. Okay. And was that back while Greenberg  
11:35:47 15 Trauring was the representative of 3M?  
11:35:49 16 A. Yes.  
11:35:50 17 Q. Okay. So would it be fair to say that if  
11:35:53 18 this MDL started in January of 2 -- December of 2015  
11:35:58 19 that you haven't read any fact depositions that were  
11:36:01 20 conducted in the MDL?  
11:36:02 21 A. Sitting here now, I cannot think of any fact  
11:36:06 22 dep -- witness depositions that I have read after the  
11:36:08 23 MDL.  
11:36:09 24 Q. Okay. After the beginning of the MDL.  
11:36:11 25 A. After the beginning of the MDL.

11:36:14 1 Thank you for correcting me.

11:36:15 2 Q. Okay. Did you have any criticisms of Dr.

11:36:19 3 Kuehn's report?

11:36:24 4 A. No.

11:36:25 5 Q. Any criticism of Dr. Settles' report?

11:36:29 6 A. No.

11:36:30 7 Q. You have no criticism of -- of his

11:36:32 8 measurement of air coming out of the Bair Hugger

11:36:35 9 between 30 to 33 degrees Celsius?

11:36:37 10 A. No.

11:36:38 11 Q. Okay. Now my understanding is is that the

11:37:07 12 invoices with respect to your expert work for 3M the

11:37:12 13 money goes directly to you; correct?

11:37:16 14 A. Yes.

11:37:16 15 Q. Okay. And the two CFD studies for research,

11:37:21 16 which is for the 750 and the 505, is money that goes

11:37:25 17 to St. Thomas; correct?

11:37:26 18 A. That's correct.

11:37:27 19 Q. Okay. So the \$15,000 in your CV for

11:37:41 20 research in 2017 for 3M is for the 505; correct?

11:38:00 21 A. Can you point to me where you're seeing

11:38:03 22 15,000?

11:38:13 23 Q. I'm sorry. Fourteen thousand. My fault.

11:38:20 24 A. That is correct.

11:38:21 25 Q. Okay. And you've kept invoices

11:38:33 1 contemporaneously with your work in this case;

11:38:35 2 correct?

11:38:36 3 A. Correct.

11:38:37 4 Q. Your invoices are complete; correct?

11:38:41 5 A. I -- Yes.

11:38:42 6 Q. And they're accurate; correct?

11:38:44 7 A. To the best of my knowledge.

11:38:46 8 Q. And they're so accurate that some months you

11:38:48 9 even submitted invoices that you had no time; correct?

11:38:50 10 A. That is correct.

11:38:51 11 Q. Okay. And even for the cost of travel you

11:38:56 12 -- you put it to the exact penny; correct?

11:39:00 13 A. I think I'm obligated to, but yes.

11:39:02 14 Q. I mean, you're an engineer, you like to be

11:39:04 15 accurate; correct?

11:39:06 16 A. I certainly don't want to overcharge someone

11:39:10 17 for work.

11:39:12 18 Q. So with respect to your invoices, and --

11:39:37 19 Do you have a copy of your invoices today?

11:39:39 20 A. No.

11:39:40 21 Q. Okay. Were you told to bring nothing to

11:39:42 22 this deposition?

11:39:42 23 A. No.

11:39:43 24 Q. You just decided to bring nothing to this

11:39:45 25 deposition?

11:39:45 1 A. That's not true.

11:39:46 2 Q. Okay. Well what did you bring to this

11:39:49 3 deposition?

11:39:49 4 A. I have some files right here, some papers

11:39:51 5 right here.

11:39:52 6 Q. Oh, I didn't see those. I'm sorry.

11:39:56 7 MR. ASSAAD: Let's take a break.

11:39:57 8 THE REPORTER: Off the record, please.

11:39:59 9 (Recess taken from 11:39 to 11:45 a.m.)

11:45:49 10 BY MR. ASSAAD:

11:45:53 11 Q. We were talking about your invoices. Would

11:45:55 12 it be fair to say if I want to determine all the time

11:45:58 13 you worked on your report that was completed by early

11:46:01 14 January, I'd just have to look at your invoices?

11:46:08 15 A. No.

11:46:11 16 Q. Let me guess. I'm assuming that's because

11:46:13 17 of the flat fee for the -- actually doing the CFD that

11:46:17 18 was paid to St. Thomas; correct?

11:46:20 19 A. Well that's -- that is one reason, but also

11:46:23 20 I tend not to -- I tend to undercharge. So, for

11:46:26 21 example, I don't charge for many phone calls, and for

11:46:29 22 travel, and so I tend to undercharge. It would be the

11:46:33 23 lower bound of the work. It's the charged amount.

11:46:37 24 Q. Okay. Because I looked at it, and by the

11:46:41 25 ti -- by the end of January you've only billed 30

11:46:44 1 hours. Does that seem about roughly how much time you  
11:46:46 2 spent, personal time that you charged directly to 3M  
11:46:52 3 on the -- your research and the report writing?  
11:46:56 4 A. That seems reasonable.  
11:46:57 5 Q. Okay. And I might have misspoke, but that  
11:47:06 6 was the beginning of 2016, correct, that you completed  
11:47:09 7 the report?  
11:47:10 8 A. That's how I in --  
11:47:11 9 Q. Okay.  
11:47:11 10 A. Well that's how I interpreted what your  
11:47:13 11 question was.  
11:47:14 12 Q. Okay. All right.  
11:47:25 13 A. But I think you said completed the report by  
11:47:27 14 2 -- early 2016?  
11:47:28 15 Q. Just the CFD portion.  
11:47:30 16 A. Okay.  
11:47:30 17 Q. That's what I meant.  
11:47:47 18 There's one thing I want to discuss if you  
11:47:50 19 know off the top of your head, but you spent about six  
11:47:53 20 hours to draft the protocol that's listed on your  
11:47:57 21 invoices. Do you know what that's referring to?  
11:47:59 22 A. Can you show me which invoice?  
11:48:20 23 Q. It was in December of 2016 and, I'm sorry, I  
11:48:24 24 misquoted, it was three hours to draft -- discussion  
11:48:27 25 of CFD and protocol and draft protocol.

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11:48:29 1 Do you recall, back in 2016, what protocol  
11:48:31 2 that would be for?  
11:48:32 3 A. No, I don't recall.  
11:48:33 4 Q. Okay. Did you speak with any of the defense  
11:48:43 5 experts?  
11:48:44 6 A. No.  
11:48:45 7 Q. So you never spoke to Gary Settles or --  
11:48:49 8 A. And in fact --  
11:48:50 9 Can I correct that?  
11:48:51 10 Q. Yes.  
11:48:51 11 A. At Science Day there were some defense  
11:48:53 12 experts there along with myself.  
11:48:57 13 Q. Fair enough.  
11:48:57 14 A. Outside of that I have not spoken to any  
11:49:00 15 defense experts.  
11:49:01 16 Q. Okay. Oh, by the way, that protocol, if it  
11:49:04 17 was in December of 2016, that would not -- that would  
11:49:08 18 not apply to your CFD analysis in your report;  
11:49:11 19 correct?  
11:49:13 20 A. Correct.  
11:49:14 21 Q. Okay. Are you a member of the American  
11:49:22 22 Society of Mechanical Engineers?  
11:49:23 23 A. No.  
11:49:23 24 Q. Were you ever a member?  
11:49:25 25 A. Yes.

11:49:26 1 Q. Why are you no longer a member?

11:49:29 2 A. The American Society of Mechanical Engineers

11:49:31 3 is a professional society where my understanding is if

11:49:35 4 you pay your annual fee you become a member, and there

11:49:39 5 wasn't much value in it for me, so I dropped

11:49:42 6 membership.

11:49:43 7 Q. Okay. But at one time you were a member;

11:49:45 8 correct?

11:49:46 9 A. I recall being a member.

11:49:48 10 Q. And at one time, you agree with me that

11:49:51 11 while you went to the University of Minnesota you took

11:49:53 12 a course on engineering ethics; correct?

11:49:56 13 A. I don't believe I did.

11:49:57 14 Q. Was -- Did any of your course involve -- any

11:50:00 15 of your studies involve engineering ethics?

11:50:03 16 A. I don't recall taking any course on

11:50:08 17 engineering ethics or a course that had a significant

11:50:11 18 part of engineering ethics. I can't remember --

11:50:13 19 Sitting here right now I cannot remember any

11:50:16 20 engineering ethics content in a course.

11:50:18 21 Q. Well do you agree that engineers uphold and

11:50:20 22 advance the integrity, honor and dignity of the

11:50:24 23 engineering profession?

11:50:26 24 A. They should.

11:50:26 25 Q. Do you agree that engineers should be

11:50:28 1 objective -- should be objective?

11:50:30 2 A. Yes.

11:50:31 3 Q. Should be honest?

11:50:32 4 A. Yes.

11:50:32 5 Q. And have integrity?

11:50:34 6 A. Yes.

11:50:34 7 Q. Do you agree that the engineers of 3M should

11:50:36 8 be held to the same standards?

11:50:38 9 A. Yes.

11:50:42 10 Q. Do you agree that engineers must use their

11:50:44 11 knowledge and skill for enhancement of human welfare?

11:50:49 12 A. Yes.

11:50:49 13 Q. Do you agree that safety should be

11:50:51 14 considered in the engineering profession, the safety

11:50:54 15 of humans?

11:50:55 16 A. Yes.

11:50:55 17 Q. And safety is paramount?

11:50:59 18 A. Well safety should be considered, should be

11:51:02 19 highly considered. I don't know about "paramount,"

11:51:05 20 but safety should be highly considered.

11:51:19 21 Q. Do you believe that in the context of

11:51:24 22 designing a device to be used by the public that

11:51:27 23 safety is more important than profits?

11:51:31 24 MR. GOSS: Object to form.

11:51:33 25 A. Yes.

11:51:35 1 Q. Engineering's a profession; correct? Not  
11:51:37 2 just a job.  
11:51:37 3 A. Correct.  
11:51:38 4 Q. Okay. And as a professor you have a duty to  
11:51:42 5 teach ethical engineering behavior; correct?  
11:51:47 6 A. If we have a class where that fits, then  
11:51:50 7 yes. But we have a duty to convey ethical behavior to  
11:51:54 8 our students.  
11:51:55 9 Q. Okay. Engineers are to serve with the  
11:51:59 10 fidelity -- with fidelity to the public; correct?  
11:52:05 11 A. Is "fidelity" truthfulness? What is  
11:52:07 12 "fidelity"?  
11:52:08 13 Q. It's the quality of being faithful or loyal.  
11:52:11 14 A. I don't know if engineers have to be loyal  
11:52:13 15 to the public.  
11:52:14 16 Q. Okay.  
11:52:14 17 A. That's not a word I would use.  
11:52:17 18 Q. Are you familiar with the St. Thomas Code of  
11:52:18 19 Ethics?  
11:52:20 20 A. I am familiar with it.  
11:52:21 21 Q. Have you read them recently?  
11:52:22 22 A. No.  
11:52:26 23 MR. GOSS: I'm just going to state my usual  
11:52:28 24 objection to ethics as an improper subject matter.  
11:52:34 25 Q. Did the St. Thomas Code of Professional

11:52:36 1 Conduct apply to you?

11:52:40 2 A. I don't know.

11:52:41 3 Q. Okay.

11:52:47 4 (Abraham Exhibit 7 marked for

5 identification.)

6 BY MR. ASSAAD:

11:52:59 7 Q. I'd like for you to turn to page 4 of 6.

11:53:05 8 Under Section VII it states: "Members of the

11:53:07 9 University community must transact University business

11:53:11 10 in compliance with applicable laws, regulations, and

11:53:14 11 University" policy -- "policies and procedures."

11:53:17 12 A. Can you tell me where you're reading?

11:53:19 13 Q. Under Section VII, first sentence.

11:53:23 14 A. I'm reading "All University financial

11:53:25 15 transactions and reports, including tax returns," and

11:53:28 16 so forth.

11:53:31 17 Q. On page 4?

11:53:35 18 A. Page 4 of 6?

11:53:37 19 Q. Under Section VII, number --

11:53:40 20 A. Oh, Section VII. Sorry. My -- My mistake.

11:53:43 21 (Witness reviewing exhibit.) Yes.

11:53:50 22 Q. Actually let's go to the first page, "POLICY

11:53:53 23 STATEMENT." It states: "The University of St. Thomas

11:53:56 24 is committed to upholding the highest ethical

11:53:59 25 standards in all that it does and expects those who

11:54:02        1 are part of the University community, including  
11:54:05        2 trustees, officers, faculty, staff, and students to  
11:54:07        3 adhere to such standards in their business dealings."

11:54:10                  Did I read that correctly?

11:54:11        5 A. Yes.

11:54:12        6 Q. Would you agree with me that this Code of  
11:54:13                  Professional Conduct applies to you?

11:54:15        8 A. Yes.

11:54:16        9 Q. Okay. And you would agree with me that even  
11:54:19        10 in your work as a consultant, as a professor of  
11:54:24                  engineering at the University of St. Thomas the Codes  
11:54:27                  of Professional Conduct listed out here apply to you.

11:54:31        13 A. I don't know if that's technically true, but  
11:54:33                  14 I would view them as applying to me.

11:54:35        15 Q. Okay. Under Section VI -- I'm sorry,  
11:55:13                  16 Section VII, the last sentence says: "Therefore, only  
11:55:20                  17 individuals who have been delegated proper authority  
11:55:25                  18 by an appropriate University official are authorized  
11:55:27                  19 to enter into contractual agreements on behalf of the  
11:55:30                  20 University."

11:55:30                  21 See where I read that?

11:55:32                  22 MR. GOSS: Are you under one of the subs?

11:55:34                  23 MR. ASSAAD: VII a., under "Contractual  
11:55:36                  24 Obligations."

11:55:37                  25 MR. GOSS: Okay.

11:55:38 1 A. Yes.

11:55:38 2 Q. Are you --

11:55:39 3 Have you been delegated proper authority to  
11:55:42 4 contract -- or enter into contractual agreements on  
11:55:49 5 behalf of the university?

11:55:53 6 A. Well I'm one of a number of people that is

11:55:58 7 able to enter into contractual obligations. I by -- I  
11:56:04 8 don't believe I, by myself, can.

11:56:06 9 Q. Okay. So you yourself can't go out and

11:56:10 10 enter in a contract on behalf of the University  
11:56:13 11 without someone else from the University involved.

11:56:15 12 A. That's my understanding.

11:56:16 13 Q. Okay. Are any professors allowed to do  
11:56:22 14 that?

11:56:23 15 A. I don't know of any professors that are  
11:56:24 16 allowed to do that.

11:56:29 17 Q. Okay. Who else at St. Thomas approved the  
11:56:38 18 research with regard to the proposal with 3M?

11:56:45 19 A. The proposals would run through the Dean and  
11:56:49 20 then the grant's office.

11:56:51 21 Q. So if I subpoena the University of St.

11:56:53 22 Thomas, I'll see documents signed by the Dean and the  
11:56:57 23 grant office with respect to approving this contract?

11:57:00 24 A. I expect you would.

11:57:01 25 Q. Okay. You agree that engineers should solve

11:57:30 1 a potential problem instead of ignoring it?

11:57:35 2 A. Possibly.

11:57:36 3 Q. Engineers that are working in the community,

11:57:39 4 not --

11:57:40 5 A. Possibly. Not always.

11:57:42 6 Q. Okay. So it's okay if -- if you're an

11:57:45 7 engineer that has a product on the market and you

11:57:47 8 identify a potential problem, to ignore it?

11:57:51 9 MR. GOSS: Object to form,

11:57:53 10 mischaracterizes.

11:57:53 11 A. That's -- It -- It's --

11:57:57 12 I would take it on a case-by-case basis.

11:58:00 13 There are some problems that are insignificant that

11:58:03 14 you can ignore, and there are some problems that may

11:58:06 15 be significant that you should not ignore.

11:58:09 16 Q. Well to determine whether or not the problem

11:58:10 17 is significant or insignificant you have to identify

11:58:15 18 the problem and determine whether or not it is

11:58:18 19 significant or insignificant; correct?

11:58:22 20 A. Correct.

11:58:23 21 Q. So you might ignore moving on with respect

11:58:27 22 to a problem, but the identification of a problem you

11:58:31 23 would not ignore.

11:58:36 24 A. Could you rephrase that question?

11:58:38 25 Q. Well to determine whether -- the

11:58:42 1 significance of a problem, you can't ignore the  
11:58:44 2 problem. You have to identify the problem and look at  
11:58:46 3 it.

11:58:47 4 A. Identifying the problem is different from  
11:58:50 5 acting on or ignoring a problem.

11:58:51 6 Q. Okay.

11:58:51 7 A. So I'm try -- I'm parsing your words.

11:58:55 8 Let me use this cup as an example.

11:59:00 9 Underneath this cup there is a small indentation,  
11:59:03 10 which is by design. Let's say that this cup comes off  
11:59:08 11 of -- By the way, it's a very nice cup. Let's say the  
11:59:11 12 cup comes off the assembly line and there's a problem  
11:59:17 13 with the manufacturing and the indentation is 10  
11:59:19 14 percent too large. That's a problem that someone may  
11:59:21 15 or may not identify and they may or may not act on it,  
11:59:25 16 so -- because it may not matter.

11:59:28 17 So the point I'm trying to distinguish is  
11:59:31 18 identifying a problem, and then making a decision to  
11:59:34 19 act on it are two different things.

11:59:36 20 Q. Okay. You agree, in any event, that  
11:59:38 21 problems involving patient risks should not be  
11:59:45 22 ignored.

11:59:47 23 A. It depends.

11:59:49 24 Q. Okay.

11:59:50 25 A. And let me --

11:59:51 1 Q. No. That's fine. I mean I --  
11:59:52 2 That's fine.  
11:59:52 3 A. Well by just saying -- by cutting me off I  
11:59:55 4 am not able to fully qualify my answer, and I think  
11:59:58 5 that the record won't be clear.  
12:00:00 6 Q. Well I'll withdraw my question then. Let's  
12:00:02 7 move on.  
12:00:06 8 So you're familiar with the 35 bridge  
12:00:15 9 collapse here in Minneapolis; correct?  
12:00:16 10 A. Yes.  
12:00:20 11 Q. Did you ever go over the bridge?  
12:00:21 12 A. Yes.  
12:00:23 13 Q. How often did you go over that bridge?  
12:00:29 14 A. One to three times per week.  
12:00:30 15 Q. Is it on your way home? At that time.  
12:00:36 16 A. Can you remind me what year it was?  
12:00:38 17 Q. 2007.  
12:00:40 18 A. It would not have been on my way home.  
12:00:42 19 Q. So why would you go over it one or two ti --  
12:00:44 20 three times a week?  
12:00:45 21 A. It's a major bridge in South St. Paul, and I  
12:00:48 22 live in sou -- South Minneapolis, and I live in South  
12:00:51 23 Minneapolis, so I'm estimating that I might go over it  
12:00:53 24 one to three times a week.  
12:00:55 25 MR. GOSS: If you went to Home Depot you

12:00:58 1 probably went over it.

12:00:59 2 A. There is a Home Depot, there's also a  
12:01:03 3 Target. Going downtown.

12:01:04 4 Q. But you didn't go over it every day;  
12:01:06 5 correct?

12:01:07 6 A. Correct. I did not go over it every day.

12:01:26 7 Q. You understand that in the 3M -- or in the  
12:01:32 8 Minnesota bridge collapse that engineers or the city  
12:01:35 9 ignored problems identified by the engineer.

12:01:38 10 MR. GOSS: Objection, lack of foundation.

12:01:40 11 Q. Are you aware of that?

12:01:41 12 A. That's not totally true.

12:01:43 13 Q. Okay. There weren't engineers that said  
12:01:47 14 that we should replace the bridge and there's  
12:01:51 15 structural problems with the bridge and just to  
12:01:52 16 monit -- and the city said just to monitor it instead  
12:01:55 17 of fixing it?

12:01:56 18 A. So I have to break that apart. First of  
12:02:00 19 all, any warnings related to the bridge collapse I  
12:02:03 20 think were associated with the questions about the  
12:02:06 21 strength of the gusset plates.

12:02:07 22 Q. Yes.

12:02:08 23 A. There were other warnings about the bridge  
12:02:10 24 that the city took action on. In fact, as I recall,  
12:02:13 25 they had annual remediation processes to maintain the

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12:02:18 1 structural integrity of the bridge. So the city did  
12:02:21 2 take action on warnings from engineers.

12:02:26 3 Now I don't recall if a specific warning  
12:02:30 4 came about from the gusset-plate issue. If the city  
12:02:35 5 decided not to fix the problem but to monitor it, that  
12:02:38 6 is still taking action. It may not have been  
12:02:41 7 appropriate action, but it still is taking action.

12:02:43 8 So it's not a simple yes-or-no answer that I  
12:02:46 9 can give there.

12:02:47 10 Q. Okay. But at the end of the day the bridge  
12:02:50 11 collapsed.

12:02:50 12 A. At the end of the day, the bridge collapsed.

12:02:52 13 Q. Okay. Just by the way, did you receive any  
12:02:55 14 --

12:03:01 15 Well do you recall some of the engineers  
12:03:03 16 stated, in the bridge collapse, that a catastrophic  
12:03:08 17 collapse was possible?

12:03:14 18 A. Boy, sitting here now I cannot recall. That  
12:03:18 19 may have occurred.

12:03:20 20 Q. By the way, did you receive any -- did you  
12:03:21 21 look at the Sessler study?

12:03:25 22 A. Yes.

12:03:25 23 Q. Were you provided the raw data regarding the  
12:03:27 24 Sessler study?

12:03:28 25 A. No.

12:03:29 1 Q. Okay. Have you looked at any other  
12:03:32 2 patient-warming devices manufactured by 3M or Arizant  
12:03:37 3 prior to the 505 model or the 750 model?  
12:03:40 4 A. Yes.  
12:03:41 5 Q. What model?  
12:03:43 6 A. I don't recall. I worked on patient warming  
12:03:46 7 with Augustine Medical at the time, back in 2000. I  
12:03:50 8 don't recall the model numbers that we worked with.  
12:03:53 9 Q. Do you recall any model numbers that warned  
12:03:56 10 about possible airborne contamination?  
12:03:57 11 A. No.  
12:03:58 12 Q. Would that be relevant to --  
12:04:00 13 Would that knowledge be relevant to your  
12:04:02 14 report?  
12:04:04 15 A. I would need to see more. I doubt it would  
12:04:06 16 be relevant.  
12:04:07 17 Q. Okay. When you worked with Augustine, what  
12:04:09 18 did you do for Augustine?  
12:04:11 19 A. I worked on characterizing the rate of heat  
12:04:16 20 transfer from the blanket to a patient and the flow  
12:04:19 21 and temperatures within the blanket.  
12:04:23 22 Q. Okay. Did you publish anything regarding  
12:04:25 23 that work?  
12:04:25 24 A. No.  
12:04:26 25 Q. Do you still have the data or information

12:04:28 1 regarding that work?

12:04:29 2 A. No.

12:04:32 3 Q. So you've met Dr. Augustine before; correct?

12:04:34 4 A. I have.

12:04:35 5 Q. Okay. When was the last time you spoke with

12:04:36 6 Dr. Augustine?

12:04:38 7 A. To my best recollection, and mind you this

12:04:42 8 is years, I think I met him at Augustine Medical.

12:04:47 9 There was a social gathering or a party, and I believe

12:04:51 10 I met him there, and I also met him after he left

12:04:55 11 Augustine Medical. He moved to a nearby location and

12:05:00 12 he had started a company, and I recall meeting him

12:05:03 13 there.

12:05:04 14 Q. Did you do for --

12:05:05 15 Did you do any work for him after -- after

12:05:07 16 he started his -- after he left Augustine Medical or

12:05:10 17 Arizant?

12:05:11 18 A. No.

12:05:11 19 Q. Okay. Have you spoken with him or anyone

12:05:14 20 from Augustine Medical since that time, since the last

12:05:19 21 conversation, by email or telephone?

12:05:21 22 A. Well Augustine Medical is no longer around,

12:05:25 23 right? Oh, oh. You mean Augustine -- Augustine --

12:05:28 24 Q. Biomedical or --

12:05:28 25 A. Okay.

12:05:29 1 Q. Any Augustine entity.

12:05:31 2 A. No.

12:05:32 3 Q. Okay. So you haven't heard from Randy

12:05:34 4 Benham or anyone else in the past five years?

12:05:39 5 A. I don't know Randy Benham. I don't recall

12:05:42 6 ever hearing from him. I did receive a subpoena,

12:05:46 7 which I don't think was from Randy Benham, but it's

12:05:50 8 possible it was.

12:05:51 9 Q. Okay.

12:05:51 10 A. But I have never spoken to him. I don't

12:05:53 11 recall any speaking or emails.

12:05:55 12 Q. Now Exhibit 2 is your CV; correct? We

12:06:00 13 already went over that.

12:06:02 14 A. Yes.

12:06:02 15 Q. Okay. Are you certified in any way by

12:06:04 16 ANSYS? Like a certified ANSYS technician or anything

12:06:07 17 like that?

12:06:07 18 A. No.

12:06:08 19 Q. Okay. What's your training in ANSYS?

12:06:12 20 A. I've taken a number of courses with ANSYS at

12:06:17 21 the undergraduate and graduate level. I've taken a

12:06:20 22 large number of short training seminars on ANSYS

12:06:25 23 premises, and I --

12:06:26 24 Q. ANSYS what?

12:06:28 25 A. Premises.

12:06:29 1 Q. Okay.

12:06:29 2 A. Both in Minneapolis and in a place called

12:06:33 3 Canonsburg, Pennsylvania.

12:06:35 4 Q. What's "ANSYS premises"?

12:06:37 5 A. Their locations.

12:06:38 6 Q. Oh, okay.

12:06:39 7 A. Their buildings.

12:06:40 8 Q. Okay.

12:06:40 9 MR. GOSS: Another legal term.

12:06:41 10 MR. ASSAAD: I thought it was a software

12:06:43 11 bundle, --

12:06:44 12 THE WITNESS: Sorry.

12:06:45 13 MR. ASSAAD: -- you know, so --

12:06:46 14 A. Thank you for helping clarify that.

12:06:48 15 And I've used ANSYS as an instructor and a

12:06:50 16 researcher throughout my career.

12:06:53 17 Q. Okay. And is this ANSYS CFX or ANSYS

12:06:57 18 Fluent?

12:06:57 19 A. We have both.

12:07:00 20 Q. But which one do you use?

12:07:02 21 A. I have used both. I currently use CFX more

12:07:04 22 often.

12:07:05 23 Q. And St. Thomas has both?

12:07:06 24 A. Correct.

12:07:06 25 Q. And what version does St. Thomas have

12:07:08 1 currently?

12:07:09 2 A. Version 18.

12:07:10 3 Q. Okay. But what version was the CFD done for

12:07:13 4 the 750?

12:07:15 5 A. 17.

12:07:16 6 Q. 17, or 17.1?

12:07:19 7 A. I don't know if it was 17.0 or .1.

12:07:23 8 Q. Would there be a difference in the results

12:07:24 9 if it was 17 or 17.1?

12:07:26 10 A. No.

12:07:28 11 Q. Okay. You're not an expert in medicine;

12:07:30 12 correct?

12:07:31 13 A. Correct.

12:07:31 14 Q. You're not an infectious disease expert;

12:07:34 15 correct?

12:07:34 16 A. Correct.

12:07:34 17 Q. So do you know how many CFUs it would take

12:07:37 18 to cause a periprosthetic joint infection?

12:07:41 19 A. No.

12:07:41 20 Q. You're not an expert in orthopedics;

12:07:42 21 correct?

12:07:43 22 A. Correct.

12:07:43 23 Q. You're not an expert in nursing; correct?

12:07:46 24 A. Correct.

12:07:46 25 Q. You're not an expert in filter

12:07:48 1 manufacturing; correct?

12:07:49 2 A. Correct.

12:07:49 3 Q. You're not an expert in medical device

12:07:51 4 design; correct?

12:07:53 5 A. Well I've designed many medical devices and

12:07:56 6 I've worked for many medical companies. I haven't

12:07:58 7 been asked, in this case, to serve as a medical device

12:08:02 8 design expert, so I'd have to give that some thought.

12:08:05 9 Q. Okay. But at this point you don't consider

12:08:07 10 yourself a medical device design expert for this case.

12:08:10 11 A. Correct.

12:08:11 12 Q. And would you hold yourself out as a patient

12:08:15 13 warmer medical device expert?

12:08:17 14 A. Yes.

12:08:18 15 Q. You would?

12:08:18 16 A. Yes.

12:08:19 17 Q. You have designed the patient-warming

12:08:21 18 devices?

12:08:21 19 A. I have worked on the design of multiple

12:08:23 20 patient-warming devices.

12:08:25 21 Q. Which ones?

12:08:27 22 A. I've worked on a device from Smiths Medical.

12:08:30 23 Q. Called?

12:08:33 24 A. It's a -- I don't know. It's EQ -- I think

12:08:36 25 the name is an EQ something, so it's numbers and

12:08:39 1 letters.

12:08:40 2 Q. Okay.

12:08:41 3 A. I have published that work.

12:08:42 4 Q. Okay.

12:08:42 5 A. I have worked on the -- I think it's called

12:08:46 6 the Ranger fluid warming system.

12:08:49 7 Q. Okay.

12:08:49 8 A. I have worked on the forced-air warming

12:08:53 9 devices through Augustine Medical.

12:08:56 10 Q. Okay.

12:08:56 11 A. And I have analyzed multiple forced-air

12:09:00 12 warming devices.

12:09:02 13 Q. Have you worked on any other patient-warming

12:09:04 14 devices besides forced-air warming?

12:09:05 15 A. Yes.

12:09:05 16 Q. Which ones?

12:09:06 17 A. The Ranger.

12:09:07 18 Q. Okay. That's a fluid warmer; correct?

12:09:09 19 A. Correct.

20 Q. Okay.

12:09:10 21 A. But it warms fluids before they're inserted

12:09:12 22 into the body, so it's essentially a patient warmer.

12:09:16 23 Q. Fair enough.

12:09:16 24 And have you used -- have you done any

12:09:19 25 research on conductive blankets or conductive devices?

12:09:23 1 A. Yes, I have done research on conductive  
12:09:25 2 devices.

12:09:29 3 Q. Okay. What conductive devices?

12:09:32 4 A. In my research, almost every heat transfer  
12:09:35 5 situation has conduction.

12:09:36 6 Q. I'm talking dealing with patient warming.

12:09:39 7 A. Oh. Thanks for the clarification.

12:09:40 8 No. I have not done work on conductive  
12:09:42 9 warming devices.

12:09:43 10 Q. Okay. You agree with me that the  
12:09:45 11 patient-warming devices are either going to transfer  
12:09:48 12 heat by either convection, conduction or radiation;  
12:09:51 13 correct?

12:09:52 14 A. I agree.

12:09:53 15 Q. Those are the only three ways of heat  
12:09:54 16 transfer that I'm aware of. Is that --  
12:09:56 17 Are there any other ways to do heat  
12:09:59 18 transfer?

12:10:00 19 A. You could have internal heat generation, but  
12:10:02 20 that -- I can't imagine that being used for a  
12:10:06 21 patient-warming device.

12:10:07 22 Q. Okay. So you agree there's multiple  
12:10:11 23 patient-warming devices out there, but just a  
12:10:16 24 different method of transferring heat.

12:10:17 25 A. I agree.

12:10:18 1 Q. Okay. Like some --

12:10:26 2 Like, for example, forced-air warming is

12:10:29 3 going to transfer heat by both convection and

12:10:31 4 conduction; correct?

12:10:33 5 A. Well it's really convection.

12:10:36 6 Q. Well would you agree with me that any part

12:10:37 7 that the blanket is touching the body it's going to

12:10:40 8 transfer heat by conduction?

12:10:42 9 A. I would agree that there would be

12:10:45 10 conduction, but the vast majority of heat is

12:10:47 11 transferred by convection.

12:10:49 12 Q. And -- And the -- the amount of heat I'm not

12:10:52 13 really going to get into, but there is some conductive

12:10:55 14 transfer when the Bair Hugger is used, Bair Hugger

12:10:56 15 blanket.

12:10:57 16 A. There is no conduction heat transfer that

12:11:01 17 does not also involve convection.

12:11:05 18 Q. Okay.

12:11:06 19 A. Would you like me to explain?

12:11:08 20 Q. I understand what you're saying, actually,

12:11:10 21 so that's fine.

12:11:10 22 Is there any radiation transfer of energy

12:11:15 23 using the Bair Hugger?

12:11:19 24 A. There -- It's the same answer for

12:11:21 25 conduction. There would be some radiation, but it's

12:11:24 1 initially caused by convection.

12:11:26 2 Q. Okay. Well... That's fine.

12:11:31 3 You're not an expert with respect to medical

12:11:35 4 device warnings; correct?

12:11:38 5 A. Did you say "warnings" or --

12:11:39 6 Q. Warnings. Warnings.

12:11:40 7 A. Correct. I am not.

12:11:42 8 Q. You're not an expert on operating room

12:11:44 9 design.

12:11:45 10 A. That is correct.

12:11:48 11 Q. Besides doing the operating-room airflow in

12:11:51 12 this case, and the 505 I guess, have you done any

12:11:55 13 other work on operating-room airflow?

12:11:58 14 A. Yes.

12:11:59 15 Q. Where?

12:12:00 16 A. I worked for a company called Precision Air

12:12:04 17 I think is their name, it was not a formal -- there

12:12:07 18 was no formal grant, but I -- I have done work and

12:12:11 19 informal consulting with them, and they design

12:12:13 20 operating-room airflow systems.

12:12:16 21 Q. Okay. So besides Precision Air and this

12:12:20 22 case, you have not worked on any operating-room

12:12:24 23 airflow systems.

12:12:25 24 A. That's correct.

12:12:26 25 Q. Do you hold yourself out as an expert in

12:12:28 1 designing HVAC systems for operating rooms?

12:12:31 2 A. I do not.

12:12:34 3 Q. Okay. The airflow system that is used in an

12:12:43 4 operating room, would you consider that laminar or

12:12:46 5 turbulent?

12:12:52 6 A. I consider all airflow in all operating

12:12:55 7 rooms turbulent because I'm using the fluid mechanics

12:12:57 8 definition of turbulence.

12:12:58 9 Q. Which is the Reynolds number; correct?

12:13:00 10 A. It's based in part on the Reynolds number.

12:13:02 11 Q. Do you know what the Reynolds number is for

12:13:04 12 the operating room that you used with respect to your

12:13:08 13 CFD analysis?

12:13:11 14 A. Can you clarify when you say "for the

12:13:13 15 operating room" used.

12:13:15 16 Q. Like for the CFD model it has airflow;

12:13:18 17 correct?

12:13:18 18 A. Correct.

12:13:19 19 Q. And that is going to have a Reynolds number;

12:13:20 20 correct?

12:13:21 21 A. No.

12:13:21 22 Q. It's not going to have a Reynolds number?

12:13:23 23 A. No.

12:13:23 24 Q. What's the Reynolds number based off of?

12:13:26 25 A. The Reynolds number is based off of flows

12:13:28        1 that have a defined velocity, a defined length of --  
12:13:32        2 of an object they're flowing around or flowing  
12:13:35        3 through, like a duct, and a viscosity.  
12:13:39                  Now for example in this room, if the camera  
12:13:42        5 would pan up -- please don't pan up -- but if it did  
12:13:46        6 pan up or pan around we would see ventilation.  
12:13:49        7 Perhaps this screen in the ceiling's a ventilation.  
12:13:53        8 We can define a Reynolds number up there within that  
12:13:56        9 ventilation shaft. But when the Reynolds number --  
12:13:59        10 when the flow gets into this room there's really no  
12:14:02        11 unique definition of the Reynolds number because  
12:14:05        12 there's no unique length. Do we use the length that's  
12:14:08        13 the height of the ceiling? Do we use the length  
12:14:10        14 that's the width of this room, according to my  
12:14:13        15 perspective? Do we use what's called the depth? Do  
12:14:15        16 we use the length, let's say, the diameter or height  
12:14:18        17 of this coffee cup? There's no unique definition.  
12:14:20        18 Q.     Okay.  
12:14:20        19 A.     So we -- it is very unusual --  
12:14:22                  I have never heard of someone defining a  
12:14:25        21 Reynolds number for a room.  
12:14:26        22 Q.     What about the Reynolds number of the  
12:14:28        23 ventilation right before it comes out of the vent, did  
12:14:30        24 you calculate that?  
12:14:31        25 A.     No.

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12:14:32 1 Q. Okay. So you don't know what it is sitting  
12:14:34 2 today -- sitting here today?

12:14:37 3 A. I don't know what it is, and it's not  
12:14:39 4 material, and I could calculate it in a matter of a  
12:14:44 5 few minutes.

12:14:44 6 Q. Okay. Do you consider your -- yourself an  
12:14:51 7 expert in particle flow?

12:14:59 8 A. Yes.

12:15:00 9 Q. Do you consider yourself an expert in  
12:15:05 10 particle movement in a turbulent flow?

12:15:08 11 A. Well I've done multiple studies on movement  
12:15:11 12 of objects and particles in a turbulent flow, so --  
12:15:16 13 and multiple peer-reviewed studies. Does that make me  
12:15:19 14 an expert? I don't know. I'd have to think about  
12:15:22 15 that.

12:15:23 16 Q. Well sitting here today, I mean, I  
12:15:26 17 understand you want to think about it, but I need a  
12:15:27 18 answer.

12:15:27 19 A. I consider myself an expert.

12:15:29 20 Q. Okay. Are you familiar with the  
12:15:35 21 Navier-Stokes equations?

12:15:37 22 A. Yes.

12:15:37 23 Q. Are you familiar with the Boussinesq  
12:15:41 24 approximation equations?

12:15:41 25 A. Yes.

12:15:43 1 Q. You agree that turbulence does not follow  
12:15:50 2 airstreams.

12:15:53 3 A. Turbul -- Well turbulence is a description  
12:15:57 4 of air motion.

12:15:57 5 Q. Yes.

12:15:58 6 A. So turbulence is not something that follows  
12:16:00 7 anything.

12:16:01 8 Q. Okay. And that's my point, it doesn't  
12:16:03 9 follow airstreams.

12:16:05 10 If it's not following anything, it's  
12:16:07 11 definitely not following airstreams.

12:16:09 12 A. Well, I mean, fluid that is turbulent that  
12:16:14 13 moves would carry its turbulence with it, but it's not  
12:16:19 14 -- someone wouldn't say turbulence follows an  
12:16:20 15 airstream.

12:16:21 16 Q. Okay. Just out of curiosity, on all your --  
12:16:27 17 I see a lot of consulting work here, and have you  
12:16:30 18 always used ANSYS?

12:16:38 19 A. No.

12:16:40 20 Q. What did you use -- What other --  
12:16:42 21 What other software device -- or software  
12:16:44 22 programs do you use?

12:16:46 23 A. I've written my own code, first of all. And  
12:16:49 24 I did use Fluent before they were part of ANSYS.

12:16:52 25 Q. Okay.

12:16:53 1 A. And now I strictly use ANSYS.

12:16:56 2 Q. Do you ever use your own code?

12:16:57 3 A. No.

12:16:57 4 Q. Have you used your co --

12:16:59 5 Has your code been verified?

12:17:02 6 A. I don't recall because it was years ago.

12:17:04 7 Q. Okay. And you know the difference between

12:17:08 8 verification and validation; correct?

12:17:11 9 A. Yes, I do.

12:17:13 10 Q. Okay. Have you used your code in any of the

12:17:14 11 consulting work you've done that's listed in your CV?

12:17:28 12 A. No, I don't believe I have. No.

12:17:31 13 Q. Okay. Now all -- all this, like for --

12:17:39 14 would it be fair to say that going from page -- from

12:17:49 15 the "grants" section on page 5, all the way down for 6

12:17:52 16 and 7 and 8, 9, page 9, all those grants, did you

12:18:02 17 primarily use either ANSYS Fluent or ANSYS CFX?

12:18:07 18 A. Well many of those grants didn't involve

12:18:10 19 CFD.

12:18:11 20 Q. Okay. But the ones that did?

12:18:12 21 A. Yes.

12:18:13 22 Q. Okay. You didn't use any of your code for

12:18:15 23 any of those grants.

12:18:16 24 A. That is correct.

12:18:17 25 Q. Okay. And the ANSYS that was used, if I

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12:18:20       1   wanted to know the version that was used could I just  
12:18:22       2   look at what version was being used by the University  
12:18:25       3   at the time?  
12:18:26       4   A.   Yes.  
12:18:28       5   Q.   Have you ever used the ANSYS at the  
12:18:32       6   University of Minnesota since you left The University  
12:18:33       7   of Minnesota?  
12:18:35       8   A.   Yes.  
12:18:36       9   Q.   In what capacity?  
12:18:38      10   A.   I was an Associate Fellow at the  
12:18:41      11   Supercomputing Institute at the University of  
12:18:44      12   Minnesota for a number of years, and my research group  
12:18:49      13   would have used ANSYS stored there.  
12:18:54      14   Q.   Okay.   Do you own ANSYS?  
12:18:58      15   A.   No.  
12:18:59      16   Q.   Okay.   So whatever you use is what the  
12:19:04      17   University has.  
12:19:05      18   A.   Correct.  
12:19:06      19   Q.   Okay.   And is --  
12:19:14      20           I mean, does the University have a full  
12:19:16      21   version of ANSYS?  
12:19:18      22   A.   We have a -- what's called a research  
12:19:20      23   license.  
12:19:21      24   Q.   Okay.  
12:19:22      25   A.   We also have student licenses.

12:19:24 1 Q. Okay. What's a research --  
12:19:25 2 I mean, but does it have the same  
12:19:27 3 capabilities of, like, what you could buy from ANSYS?  
12:19:34 4 A. I believe it does.  
12:19:35 5 Q. Does it have any limitations of how many --  
12:19:40 6 like how big of a mesh it would calculate, or --  
12:19:43 7 A. I don't think the research license has any  
12:19:45 8 limitations. If that's important, I could check.  
12:19:50 9 But sitting here now I think the research  
12:19:53 10 license has all of the capabilities.  
12:19:56 11 Q. Okay. With respect to the, say, for  
12:20:05 12 example, the \$12,000 given to St. Thomas, do you  
12:20:08 13 receive any money from that?  
12:20:09 14 A. Yes.  
12:20:10 15 Q. What percentage?  
12:20:12 16 A. I probably received approximately half of  
12:20:16 17 that. I would have to check.  
12:20:17 18 Q. Okay. And with respect to most of the  
12:20:20 19 consulting work that you -- or grants that you have  
12:20:25 20 listed in your CV, would it be about the same  
12:20:28 21 percentage?  
12:20:29 22 A. No.  
12:20:30 23 Q. What would be the difference? Is it a case  
12:20:32 24 by case?  
12:20:33 25 A. It's case by case.

12:20:34 1 Q. But would you agree with me that on some of  
12:20:36 2 them you do receive compensation?  
12:20:38 3 A. Yes.  
12:20:38 4 Q. Okay. Like, for example, you did something  
12:20:41 5 in 2015 for Mador Technologies, M-A-D-O-R. You got  
12:20:47 6 \$20,000. Did you receive any personal, like,  
12:20:51 7 compensation?  
12:20:52 8 A. I did not.  
12:20:53 9 Q. Okay. What about Amphora Medical of  
12:21:14 10 fifty-five thousand point five -- 55.5 thousand; did  
12:21:18 11 you receive any compensation?  
12:21:19 12 A. Yes.  
12:21:19 13 Q. What percentage of that was direct  
12:21:21 14 compensation to you?  
12:21:24 15 A. I would estimate I received 10 to 15,000.  
12:21:29 16 Q. Okay. Windstrip, LLC. Do you recall doing  
12:21:39 17 work for them?  
12:21:40 18 A. Yes.  
12:21:40 19 Q. And it was 250,000 for development of  
12:21:44 20 vertical axis wind turbines?  
12:21:47 21 A. Yes.  
12:21:48 22 Q. Did you receive any personal compensation  
12:21:50 23 directly for you?  
12:21:51 24 A. Four thousand dollars.  
12:21:52 25 Q. Four thousand?

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12:21:53 1 A. Correct.

12:21:53 2 Q. And that's not an estimate?

12:21:55 3 A. That is exact.

12:21:57 4 Q. Okay. Most of -- These -- Most -- Well,

12:22:03 5 strike that.

12:22:03 6 With respect to a lot of these grants, are

12:22:05 7 these grants that you've obtained while working at St.

12:22:08 8 Thomas or The University of Minnesota, or did you work

12:22:10 9 with somebody else that obtained the grants?

12:22:13 10 Do you understand the question?

12:22:14 11 A. No.

12:22:15 12 Q. For example, with 3M it was you that was the

12:22:19 13 person that worked with 3M and obtained the grant for

12:22:22 14 St. Thomas. You understand that; correct?

12:22:25 15 A. Yes.

12:22:25 16 Q. With respect to these other grants, were you

12:22:28 17 the direct contact with The University of St. Thomas

12:22:31 18 or University of Minnesota, or was this -- you're just

12:22:36 19 itemizing grants that were received by St. Thomas or

12:22:39 20 The University of Minnesota that you worked on?

12:22:41 21 A. For the vast majority of them I was the --

12:22:44 22 Q. Okay.

12:22:44 23 A. -- primary contact and recipient.

12:23:07 24 Q. Are you familiar with the ANSYS User's

12:23:09 25 Guide?

12:23:10 1 A. Yes.

12:23:11 2 Q. Do you agree with me that it's authoritative

12:23:14 3 on how to use ANSYS and its capabilities?

12:23:17 4 A. I don't know -- I don't know if I'd use -- I

12:23:19 5 don't know if I'd ever use the word "authoritative."

12:23:23 6 I would agree that it describes how to use ANSYS, and

12:23:25 7 its capabilities.

12:23:26 8 Q. Okay. You agree with me that the

12:23:27 9 programmers of ANSYS would probably know more about

12:23:30 10 ANSYS's capabilities than you do.

12:23:33 11 A. In general, yes. I might know more about

12:23:36 12 some small feature.

12:23:38 13 Q. Okay. Now I assume that you are aware of

12:23:49 14 the basic laws of physics.

12:23:51 15 A. Yes.

12:23:51 16 Q. Okay. You agree with me that in a case such

12:23:58 17 as this the law of thermodynamics applies.

12:24:01 18 A. Yes.

12:24:01 19 Q. Okay. And with respect to a complex model,

12:24:05 20 which this is, as you described earlier, everything

12:24:09 21 needs to be accounted for; correct?

12:24:11 22 A. I disagree.

12:24:12 23 Q. Okay. Why?

12:24:13 24 A. Not everything matters.

12:24:15 25 Q. Okay. Would you agree with me that

12:24:16 1 everything that matters needs to be accounted for?

12:24:18 2 A. Everything that --

12:24:20 3 Things that can significantly affect the

12:24:22 4 results --

12:24:24 5 Q. Okay.

12:24:24 6 A. -- need to be accounted for.

12:24:26 7 Q. All right. So, for example, in your

12:24:31 8 assumptions you determined what you would consider

12:24:34 9 significant that could affect the results and not

12:24:36 10 affect the results; correct?

12:24:42 11 A. Yes.

12:24:43 12 Q. For example, you -- you removed some

12:24:48 13 geometry because when you were creating -- when you

12:24:51 14 were -- you assumed, based on your education, training

12:24:54 15 and experience, that that geometry would have no

12:24:57 16 effect on the results, or very little effect.

12:24:59 17 A. Correct.

12:25:00 18 Q. So your assumptions -- you make assumptions

12:25:04 19 about what would affect or not affect the model.

12:25:09 20 A. Yes.

12:25:10 21 Q. Okay. So you'd agree with me that if a heat

12:25:16 22 source would affect the model significantly, that

12:25:18 23 needs to be included in a model.

12:25:20 24 A. If it would affect the question you're

12:25:23 25 trying to answer, then yes.

12:25:25 1 Q. Okay. And let's just agree that when I say  
12:25:28 2 "the problem," or "the model," we're talking about the  
12:25:31 3 ques -- you're creating a model to answer a question.  
12:25:34 4 A. Correct.  
12:25:35 5 Q. Okay. So you agree with me that if people  
12:25:39 6 would significantly affect the model, they should be  
12:25:41 7 included.  
12:25:43 8 A. Yes.  
12:25:44 9 Q. Okay. You agree with me that the inlets and  
12:25:50 10 outlets of a room should be included if it would  
12:25:54 11 significantly affect the model.  
12:25:56 12 A. Yes.  
12:25:56 13 Q. Okay. And the goal is to be as accurate as  
12:26:02 14 possible to put into a model things that may  
12:26:07 15 significantly affect the results.  
12:26:13 16 A. Yes.  
12:26:21 17 Q. You agree with me that if the model is not  
12:26:23 18 accurate, the model is not reliable.  
12:26:39 19 A. I would say this: If the model does not  
12:26:42 20 have the ingredients which are significant and may  
12:26:46 21 affect the question being asked of the model, then it  
12:26:50 22 is not reliable.  
12:26:51 23 Q. Okay. You agree with me that if you use the  
12:27:05 24 wrong mathematical equations, the model's not  
12:27:10 25 reliable.

12:27:11 1 A. Yes.

12:27:13 2 Q. By the way, you agree with me that particles

12:27:15 3 do not follow airstreams; correct?

12:27:18 4 A. They may or may not follow airstreams.

12:27:21 5 Q. Depending on the size; correct?

12:27:24 6 A. Correct.

12:27:25 7 Q. Okay. Because particles have inertia.

12:27:28 8 A. That is correct.

12:27:28 9 Q. Okay. What size particles follow airstreams

12:27:31 10 as compared to size particles that don't follow

12:27:34 11 airstreams?

12:27:36 12 A. I cannot answer that question in the

12:27:38 13 abstract because it depends on the airstreams.

12:27:40 14 Q. Okay. In the airstreams in this case --

12:27:44 15 with the velocity of the airstreams in this case, do

12:27:46 16 you have any idea, sitting here today, what -- what

12:27:49 17 size particles would follow the airstreams as compared

12:27:51 18 to not follow the airstreams?

12:27:54 19 A. No.

12:27:55 20 Q. Okay. The fact that we have eight people --

12:28:26 21 seven people sitting in this room, does that affect

12:28:28 22 the temperature of this room?

12:28:32 23 A. It may.

12:28:33 24 Q. Okay. But you can't assume that it doesn't.

12:28:44 25 A. The reason why I'm pausing is the answer

12:28:49        1     involves more than just the presence of eight people,  
12:28:53        2     it involves the ventilation system and the control  
12:28:55        3     system. So it's possible, and I would say likely,  
12:29:00        4     that when more people enter this room the control  
12:29:03        5     system reacts so that more -- more air, ventilation  
12:29:08        6     air is supplied. So in that respect it's likely the  
12:29:11        7     presence of people in this room does not affect the  
12:29:13        8     temperature.

12:29:15        9           Q. Well it's going to affect the temperature to  
12:29:17        10      a point in which the system reacts to it.

12:29:20        11      A. I would agree.

12:29:21        12      Q. Okay. So it has an effect on the  
12:29:23        13      temperature.

12:29:24        14      A. I agree, but it's unlikely to have a lasting  
12:29:28        15      effect.

12:29:28        16      Q. Okay. Well we're not talking about -- I'm  
12:29:30        17      just saying an effect, whether or not it's an  
12:29:32        18      instantaneous effect. I'm just saying it's going to  
12:29:35        19      have an effect.

12:29:36        20      A. I agree.

12:29:37        21      Q. The laws of thermodynamics, we're all  
12:29:38        22      putting off heat, energy, it's the conservation of  
12:29:41        23      energy, it's going to have an effect.

12:29:43        24      A. That is correct.

12:29:44        25      Q. Okay. And you yourself, I think what I'm

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12:29:50 1 understanding, is you made assumptions with respect to  
12:29:54 2 your CFD analysis of what would have an effect and not  
12:29:58 3 have an effect; correct?  
12:30:00 4 A. No.  
12:30:01 5 Q. Well there are no people in your CFD  
12:30:04 6 geometry; correct?  
12:30:05 7 A. That is correct.  
12:30:06 8 Q. Except -- Except for the patient.  
12:30:07 9 A. That's correct.  
12:30:07 10 Q. So you assumed that the people are not going  
12:30:10 11 to have effects on the airflow.  
12:30:12 12 A. No.  
12:30:13 13 Q. Are they going to have an effect?  
12:30:14 14 A. People in an OR will have an effect.  
12:30:17 15 Q. Okay. But you did not put that in your CFD.  
12:30:20 16 A. That's correct, and there's a reason why.  
12:30:22 17 Q. Why?  
12:30:24 18 A. The question I was trying to ans -- ask in  
12:30:29 19 my CFD model is does the Bair Hugger have the  
12:30:32 20 potential of disrupting the normal airflow in the  
12:30:36 21 operating room. Now I could have put people in the  
12:30:40 22 room, and in fact I could have put moving people in  
12:30:45 23 the room, but the fact of the matter is, movement  
12:30:50 24 would dominate any effect the Bair Hugger would have.  
12:30:55 25 So if there was some kind of motion of air in the

12:30:58        1 room, it would likely be from the humans. What I  
12:31:02        2 wanted to do was isolate the Bair Hugger, in a certain  
12:31:05        3 sense it's a worst-case scenario. Without any other  
12:31:08        4 thing that will hide the effect of the Bair Hugger,  
12:31:13        5 what is the effect of the Bair Hugger.  
12:31:15                6 Now what I also did, though, is did  
12:31:20        7 experiments, and in those experiments there were  
12:31:23        8 people, with heat, moving in a simulated surgery, and  
12:31:27        9 the results corroborated my calculations.  
12:31:30        10 Q. When did you do the experiments; before or  
12:31:32        11 after the CFD?  
12:31:34        12 A. The experiments would have been done be --  
12:31:40        13 after. I'm sorry.  
12:31:40                14 The experiments were done before the CFD  
12:31:42        15 results.  
12:31:43        16 Q. Okay. Now you agree with me that it's  
12:32:03        17 normal to have people in the OR.  
12:32:05        18 A. I would agree.  
12:32:06        19 Q. And you agree that -- you've seen videos of  
12:32:10        20 total hip and total knee surgeries; correct?  
12:32:14        21 A. I have not seen a complete video of a total  
12:32:16        22 hip and total knee surgery. I've seen -- So no. The  
12:32:20        23 answer is no.  
12:32:20        24 Q. I didn't ask for a complete video, but  
12:32:22        25 you've seen some videos, at least portions.

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12:32:25        1        A.     I've seen portions of videos of either hip  
12:32:27        2        or knee re -- surgeries.  
12:32:28        3        Q.     I mean, you were at Science Day.  
12:32:30        4        A.     That's right.  
12:32:30        5        Q.     Okay. So I know you've seen it.  
12:32:31        6        A.     Well, hold on. But you asked two different  
12:32:34        7        types of surgeries, and my recollection is it was just  
12:32:36        8        one type. I could be wrong.  
12:32:37        9        Q.     Okay.  
12:32:38        10      A.    So I didn't want to overrepresent my video  
12:32:41        11      watching.  
12:32:42        12      Q.     So are you assuming that -- Strike that.  
12:32:48        13      You agree that even if you have non-moving  
12:32:52        14      people in an operating room it's going to affect  
12:32:56        15      airflow.  
12:32:57        16      A.     Yes.  
12:32:57        17      Q.     Okay. Especially if the people are around  
12:33:03        18      the operating room table it's going to affect the  
12:33:05        19      airflow underneath the operating room table.  
12:33:09        20      A.     I don't know if I agree with that.  
12:33:11        21      Q.     Well you're -- you're causing -- you are  
12:33:14        22      causing blockages underneath the operating room table  
12:33:18        23      because you have people standing next to it, correct,  
12:33:21        24      and that's going to affect the air underneath the  
12:33:23        25      operating room table.

12:33:23 1 A. You are causing blockages, but the effect of  
12:33:26 2 airflow underneath the operating room because of those  
12:33:29 3 blockages would be negligible.

12:33:38 4 Q. Okay. In your CFD model did you -- I  
12:33:43 5 remember this from college, because I did very little.  
12:33:46 6 I wasn't big when I was in college.

12:33:49 7 Like I remember you could put in, like,  
12:33:51 8 material properties, like, for heat transfer and  
12:33:55 9 stuff. Was that done in this CFD?

12:33:58 10 A. You can put in material properties for the  
12:34:01 11 materials.

12:34:01 12 Q. Yes.

12:34:02 13 A. We wouldn't say put in a material property  
12:34:04 14 for heat transfer, because heat transfer doesn't have  
12:34:06 15 a property. But it's true, you put in material  
12:34:09 16 properties.

12:34:09 17 Q. Well heat transfer is for different objects  
12:34:12 18 differently and different materials differently;  
12:34:14 19 correct?

12:34:15 20 A. That's correct.

12:34:15 21 Q. And that -- like, for example, in your  
12:34:17 22 research when -- because you do a lot of heat  
12:34:18 23 transfer; correct?

12:34:20 24 A. Correct.

12:34:20 25 Q. And I -- I can't remem --

12:34:22 1 What's the term used for how much an object  
12:34:24 2 absorbs heat, or -- Is it heat index or heat  
12:34:28 3 coefficient? Specific heat.  
12:34:29 4 A. Specific heat.  
12:34:31 5 Q. That's it, specific heat.  
12:34:32 6 Was the specific heat ever -- did you use  
12:34:34 7 that at all with respect to your CFD analysis?  
12:34:36 8 A. Yes.  
12:34:37 9 Q. What -- What did you apply specific heat to?  
12:34:39 10 A. The air.  
12:34:40 11 Q. Anything else?  
12:34:42 12 A. No.  
12:34:44 13 Q. What about the blanket, the -- the Bair  
12:34:47 14 Hugger blanket?  
12:34:51 15 A. I did not apply a specific heat to the Bair  
12:34:54 16 Hugger blanket.  
12:34:55 17 Q. Okay.  
12:34:56 18 A. It was not necessary.  
12:34:59 19 Q. What about the drapes?  
12:35:03 20 A. Same answer.  
12:35:03 21 Q. What about the patient?  
12:35:06 22 A. Same answer.  
12:35:07 23 Q. So you didn't put -- you didn't apply any  
12:35:10 24 specific heat.  
12:35:11 25 A. Correct.

12:35:11 1 Q. What about to the walls?

12:35:13 2 A. I did not --

12:35:14 3 Same answer.

12:35:15 4 Q. Okay. So is it fair to say that the only

12:35:20 5 fluid you applied specific heat to was the air?

12:35:23 6 A. That's the only fluid in the model, so yes.

12:35:26 7 Q. Okay. Well when I took fluid dynamics I was

12:35:31 8 told that everything's a fluid, even solids.

12:35:34 9 A. You were told incorrectly.

12:35:35 10 Q. Okay. They're just different densities.

12:35:38 11 A. You were still told incorrectly.

12:35:40 12 Q. Okay. It was Engineering 101 I guess.

12:35:46 13 MR. GOSS: Kind of wish I'd taken that

12:35:47 14 class.

12:35:48 15 (Laughter.)

12:35:50 16 THE WITNESS: You still can.

12:35:51 17 Q. Were there any solids in your analysis?

12:35:55 18 A. No.

12:35:57 19 Q. So now I'm really confused, because I look

12:36:00 20 at the pictures and there is a operating room table.

12:36:03 21 Is that not a solid?

12:36:05 22 A. No. What you see is the interface between

12:36:08 23 the table and the fluid. You're not seeing inside the

12:36:13 24 operating room table itself.

12:36:15 25 So if I use this table as an example, what

12:36:20 1 you see is this top interface, but when you look at  
12:36:24 2 the model you're not looking at the wood grains  
12:36:27 3 inside, and that's the difference.

12:36:28 4 Q. So is it like a void in the model?

12:36:33 5 A. It is a void in the model, but that -- using  
12:36:37 6 that term is misleading.

12:36:39 7 Q. I know. I don't know what...

12:36:40 8 Like, for example, I mean it -- there's the  
12:36:44 9 table, but it's not really there, it's just telling  
12:36:47 10 that, like, it's a barrier type thing.

12:36:50 11 A. That's right.

12:36:51 12 Q. Okay. So -- So you would agree with me that  
12:36:55 13 --

12:37:01 14 What's the word? Is it adiabatic?

12:37:07 15 A. Adiabatic is the word meaning insulated, and  
12:37:11 16 I -- I used adiabatic surfaces to represent solids.

12:37:16 17 Q. Okay. Which means that there's no heat  
12:37:17 18 transfer among the solids.

12:37:19 19 A. Correct.

12:37:19 20 Q. So you had no heat transfer between the Bair  
12:37:23 21 Hugger blanket and the drapes.

12:37:27 22 A. Correct.

12:37:29 23 Q. But we know in the real world that's not  
12:37:31 24 accurate.

12:37:35 25 A. In the real world you have cool air on one

12:37:46 1 side which would cool off the drape. I didn't account  
12:37:50 2 for that cool air heat transfer to the drape, nor did  
12:37:55 3 I account for heat from any Bair Hugger air to the  
12:37:59 4 drape because it wasn't material to my analysis.

12:38:03 5 Q. Okay. Would you agree with me that what was  
12:38:13 6 material to your analysis -- Strike that.

12:38:16 7 Did you do the measurements in the OR that  
12:38:46 8 account for your geometry?

12:38:49 9 A. No. The measurements were sent to me. I  
12:38:53 10 double-checked the width and length of the room, but I  
12:38:56 11 did not do other measurements.

12:38:58 12 Q. How many times did you go visit the OR that  
12:39:00 13 you modeled?

12:39:01 14 A. Once.

12:39:02 15 Q. And that would have been in 2015?

12:39:04 16 A. Yes.

12:39:05 17 Q. Who was there with you?

12:39:09 18 A. Attorneys, or maybe it was one attorney, I  
12:39:11 19 can't recall, from the initial law firm. There were I  
12:39:20 20 believe hired surgeons and nurses who replicated a  
12:39:24 21 surgery. An attorney from 3M, Janell. Two engineers  
12:39:31 22 from 3M. And Jennifer Wagner and Brian Plourde. And  
12:39:41 23 I think two lighting people.

12:39:44 24 Q. "Lighting"?

12:39:44 25 A. Or cam -- camera people.

12:39:45 1 Q. Oh, was this filmed?

12:39:48 2 A. The --

12:39:49 3 Q. The experiments?

12:39:50 4 A. The visualization in the OR?

12:39:52 5 Q. Yeah.

12:39:52 6 A. Yes.

12:39:56 7 Q. Okay. Do you know how much film was taken?

12:39:58 8 A. I have no idea.

12:39:59 9 Q. Okay. The two engineers from 3M, do you

12:40:02 10 know who they are?

12:40:02 11 A. I know one of them.

12:40:04 12 Q. Who?

12:40:04 13 A. Andy Chen.

12:40:06 14 Q. Who's Andy Chen?

12:40:07 15 A. An engineer from 3M.

12:40:09 16 Q. Is that how you know him? Did you know him

12:40:11 17 before that day?

12:40:12 18 A. I did know him --

12:40:13 19 Q. Okay.

12:40:13 20 A. -- before that day.

12:40:15 21 Q. How?

12:40:15 22 A. I think he got his Ph.D. under Sparrow, who

12:40:19 23 was my doctoral advisor.

12:40:20 24 Q. Before or after you?

12:40:21 25 A. After me.

12:40:23 1 Q. Okay. So he's a Ph.D.?

12:40:29 2 A. Yes.

12:40:30 3 Q. And in what, mechanical engineering?

12:40:31 4 A. In mechanical engineering with a specialty

12:40:33 5 in the thermal sciences.

12:40:34 6 Q. Okay.

12:40:34 7 A. Which is heat and fluid flow.

12:40:36 8 Q. Does he do CFD?

12:40:38 9 A. I -- Yes, he does.

12:40:40 10 Q. Okay. Does 3M have the capability of doing

12:40:47 11 their own CFD analysis?

12:40:49 12 A. I believe they do.

12:40:50 13 Q. So why'd they hire you?

12:40:52 14 A. I don't know.

12:40:53 15 Q. They could have done this internally?

12:40:56 16 A. It's possible.

12:40:56 17 Q. Okay. Do you know what soft --

12:40:58 18 Do they have their own proprietary software,

12:41:00 19 or do they use a commercial product like you?

12:41:03 20 A. I don't --

12:41:04 21 Sitting here, I don't know the answer to

12:41:05 22 that.

12:41:06 23 Q. Okay. Maybe I should ask this question:

12:41:09 24 Have you seen any CFD models done by 3M?

12:41:13 25 A. No, I have not.

12:41:30 1 Q. Is there a geometry created for the Bair  
12:41:38 2 Hugger blower, or outlet, where the air blows?  
12:41:43 3 A. Oh, you have to be more specific. I'm  
12:41:44 4 confused.  
12:41:45 5 Q. Well, for example, there's geometry for the  
12:41:48 6 ventilation of the ducts or the vents; correct?  
12:41:51 7 A. Yes.  
12:41:51 8 Q. And there's geometry for the intake vents.  
12:41:54 9 A. Yes.  
12:41:56 10 Q. Now I've seen mixed terms of people calling  
12:42:01 11 air coming in as an inlet. I've heard people calling  
12:42:07 12 it as an outlet because it's coming out. What term do  
12:42:10 13 you use?  
12:42:11 14 A. It's an inlet to the room.  
12:42:12 15 Q. Okay. Is there a geometry for the Bair  
12:42:14 16 Hugger inlet?  
12:42:15 17 A. There is a geometry for the Bair Hugger  
12:42:20 18 inlet to the room in the sense that the room -- the  
12:42:23 19 Bair Hugger air enters into the room.  
12:42:26 20 Q. Okay. Is that --  
12:42:27 21 Does it have an area for the geometry?  
12:42:29 22 A. Yes.  
12:42:30 23 Q. What is the area?  
12:42:30 24 A. Sitting here now, I don't know.  
12:42:32 25 Q. Could it be --

12:42:33 1 Could you get it from the TRN file?

12:42:35 2 A. Yes.

12:42:36 3 Q. Okay. And how'd you calculate that area?

12:42:39 4 A. It was part of the initial CAD file.

12:42:44 5 Q. Okay. And where is that geometry where the

12:42:51 6 air is coming out?

12:42:55 7 A. Do you mean where in the model is it?

12:42:57 8 Q. Yes.

12:42:58 9 A. It's near the head and neck --

12:42:59 10 Q. So if we --

12:43:01 11 A. -- it shows.

12:43:04 12 Q. -- go to your report. Let's go to Exhibit

12:43:04 13 1. What picture would best show me where the air is

12:43:23 14 coming out?

12:43:25 15 And please don't give me the one with all

12:43:26 16 the dot -- dotted lines in it.

12:43:31 17 A. Figure 1(a).

12:43:32 18 Q. Okay. And where is the air coming out?

12:43:34 19 A. Can I mark it up?

12:43:35 20 Q. Yes. Why don't you mark it with a --

12:43:39 21 Do you have a pen on you?

12:43:40 22 A. No.

12:43:42 23 Q. Use --

12:43:43 24 [Red pen provided by the court reporter.]

12:43:43 25 MR. ASSAAD: Can we film that, please?

12:43:44 1 There's a camera above you, so.

12:43:49 2 THE WITNESS: Oh, great. Is it centered?

12:43:54 3 Is it good?

12:43:57 4 (Discussion off the stenographic record.)

12:43:59 5 THE WITNESS: Can you see that?

12:44:04 6 Q. Can I see it, please?

12:44:06 7 A. Yes. (Handing.)

12:44:08 8 Q. Okay. Is it coming from --

12:44:10 9 Do you know whether or not it's coming from

12:44:12 10 the front of the body or the back of the body?

12:44:14 11 A. Both.

12:44:16 12 Q. Both? Okay.

12:44:18 13 And so if I looked at the TRN file you're

12:44:20 14 absolutely certain it comes out of both?

12:44:22 15 A. Yes.

12:44:24 16 Q. Okay. And what's the --

12:44:26 17 And you assumed that all the air comes out

12:44:28 18 of the head and neck; correct?

12:44:30 19 A. That is correct.

12:44:32 20 Q. Why did you make that assumption?

12:44:34 21 A. Well there's a number of reasons. First of

12:44:36 22 all, I saw the draping that was done and I saw that

12:44:38 23 the draping channels the airflow so that once it

12:44:40 24 touches the body, once it touches the body the air

12:44:42 25 will migrate vertically upwards and it will exhaust

12:44:54 1 near the drape -- near the head and neck.

12:44:57 2 There is also prior literature that's been

12:45:00 3 cited in this case that confirms my understanding that

12:45:03 4 the air enters the room through the head or neck area.

12:45:09 5 In addition, the Bair Hugger has tape on it

12:45:12 6 which adheres the Bair Hugger to the body so in those

12:45:15 7 portions the air can't go elsewhere. And in this case

12:45:19 8 on one side the Bair Hugger was wrapped around the

12:45:22 9 back of the patient so there was no other alternative

12:45:25 10 for it to go.

12:45:27 11 These views were confirmed by Dr. Kuehn's

12:45:32 12 measurements when he took measurements of airflow near

12:45:34 13 the Bair Hugger.

12:45:35 14 Q. Okay. And you're talking about Dr. Kuehn's

12:45:42 15 measurements that when he raised the -- when he turned

12:45:44 16 the Bair Hugger on, the temperature of the room went

12:45:46 17 down?

12:45:47 18 MR. GOSS: Object to form.

12:45:48 19 A. I am not --

12:45:49 20 I'm not talking about that measurement, and

12:45:52 21 I don't believe that that's a correct characterization

12:45:53 22 of what he did.

12:45:55 23 Q. Have you ever heard the term "junk science"?

12:45:59 24 A. Yes.

12:46:00 25 Q. Okay. Is that a signif -- Is that a --

12:46:12 1 You made the assumption, based on your  
12:46:12 2 analysis, that all the air comes out of the head and  
12:46:16 3 neck area; correct?

12:46:18 4 MR. GOSS: Object to form, mischaracterizes  
12:46:20 5 the testimony.

12:46:23 6 A. You said "made the assumption based" -- I  
12:46:25 7 think you said "based on the analysis." I actually  
12:46:29 8 made the determination based on multiple, mutually  
12:46:32 9 reinforcing lines of evidence.

12:46:34 10 Q. Okay. But that's an assumption that you  
12:46:35 11 made in your CFD analysis; correct?

12:46:37 12 A. That is correct.

12:46:38 13 Q. Okay. If that assumption is incorrect,  
12:46:42 14 would you agree with me that your model is incorrect?

12:46:45 15 A. No.

12:46:45 16 Q. Why?

12:46:46 17 A. My model may or may not be incorrect if that  
12:46:50 18 boundary condition is incorrect.

12:46:52 19 Q. Okay. If you've made that -- Let's take it  
12:46:54 20 this way.

12:46:55 21 You can't sit here today and say your model  
12:46:58 22 is correct if that assumption is incorrect that all  
12:47:01 23 the air comes out of the head and neck.

12:47:03 24 MR. GOSS: Object as calling for  
12:47:05 25 speculation.

12:47:05 1 A. I disagree.

12:47:07 2 Q. Well you just said it may or may not be

12:47:09 3 correct.

12:47:09 4 A. You used the word "all." Let's say, for

12:47:14 5 example, 99 percent of --

12:47:15 6 Let's say we find out tomorrow 99 percent of

12:47:17 7 the air comes out by the head and 1 percent comes out

12:47:22 8 somewhere else. There's no reason to think that my

12:47:25 9 results wouldn't be accurate.

12:47:29 10 Q. What if it was 50/50?

12:47:31 11 A. I don't --

12:47:32 12 Sitting here, I don't know the answer to

12:47:33 13 that.

12:47:34 14 Q. Okay. So let's assume that half the air

12:47:36 15 comes out of the hair and neck and half -- half the

12:47:39 16 air goes down below the drape. Would you agree with

12:47:42 17 me that the model that you have submitted as part of

12:47:46 18 Exhibit 1 cannot be confirmed as correct?

12:47:53 19 MR. GOSS: Object to form.

12:47:54 20 A. I disagree.

12:47:56 21 Q. Okay. Why?

12:47:59 22 A. Well first of all I disagree with the

12:48:01 23 hypothetical, but let's assume your hypothetical's

12:48:03 24 correct.

12:48:04 25 Q. You don't have to agree with my

12:48:06 1 hypothetical.

12:48:06 2 A. I know. But I'm getting on the record that  
12:48:08 3 I -- there's no basis for the hypothetical, and I want  
12:48:10 4 -- I want that clear.

12:48:11 5 But let's say that it is correct and air  
12:48:16 6 exhausts somewhere else. The fact of the matter is,  
12:48:21 7 the easiest pathway -- buoyant air wants to rise, hot  
12:48:25 8 air wants to rise, and the easiest pathway would --  
12:48:28 9 would be for it to rise up through the location which  
12:48:32 10 I've articulated on this diagram. So even if air came  
12:48:36 11 out somewhere else, it's my opinion it would  
12:48:40 12 ultimately enter the -- enter -- it would likely enter  
12:48:42 13 the room through the place I've just annotated.

12:48:45 14 Q. Okay. Assuming that 50 percent of the air  
12:48:49 15 was exhausted to below the operating room table, and  
12:48:54 16 50 percent of the air came out of the head and neck,  
12:48:58 17 would you agree with me that you can't confirm that  
12:49:00 18 the model is correct?

12:49:02 19 MR. GOSS: Same objection.

12:49:04 20 A. Sitting here now --

12:49:06 21 I mean the word "confirm" to a scientist has  
12:49:11 22 a very high bar. Sitting here now, if -- I would like  
12:49:19 23 to know more about the hypothetical. If -- If hot air  
12:49:22 24 is vented beneath the table, it's my opinion, sitting  
12:49:26 25 here now, it is -- would most likely rise and still

12:49:31        1 exit through the head and neck, so I would have no  
12:49:33        2 reason to doubt my results.

12:49:35        3 Q.     So your assumption is that no matter where  
12:49:37        4 the hot air goes, at the end of the day all of it's  
12:49:41        5 going to come out of the head and neck.

12:49:42        6 A.     That is not my assumption, and I didn't  
12:49:45        7 state that.

12:49:46        8 Q.     Well you said if the hot air rises, the hot  
12:49:48        9 air is going to rise no matter where it goes, and then  
12:49:51        10 it's going to come out of the head and neck area.

12:49:53        11 Do I need to read your answer again?

12:49:55        12 A.     No. I know the answer.

12:49:56        13 What you said is if 50 percent of the hot  
12:49:59        14 air goes beneath the table and 50 percent dir -- is  
12:50:02        15 vented directly from the head and neck, would that  
12:50:03        16 invalidate my results. And in that case it's my  
12:50:07        17 opinion the air would most likely still leave by the  
12:50:10        18 head and neck.

12:50:11        19 But let's say 50 percent of the hot air  
12:50:13        20 exited by the foot of the patient. Well then I would  
12:50:17        21 change my answer because that air would not rise by  
12:50:20        22 the head and neck, so -- so I am not -- so I think you  
12:50:24        23 mischaracterized my testimony.

12:50:25        24 Q.     Okay.

12:50:38        25 MR. GOSS: Gabe, if you get to a good spot

12:50:40 1 for a lunch break, let us know.

12:50:43 2 MR. ASSAAD: Okay.

12:51:07 3 Q. Do you believe it's possible that based on  
12:51:09 4 the geometry that air -- hot air could escape to the  
12:51:15 5 side of the drape?

12:51:18 6 A. Can you define what you mean by "the side of  
12:51:20 7 the drape"?

12:51:20 8 Q. Like you have a head, the feet, and then the  
12:51:24 9 two sides. Do you think, based on your geometry, that  
12:51:30 10 air could escape the sides, hot air, below the drape  
12:51:32 11 to the side?

12:51:33 12 A. No.

12:51:33 13 Q. Okay. And what's your basis behind that?  
12:51:37 14 Scientific basis.

12:51:39 15 A. Well let's take this case as an example. On  
12:51:44 16 the one side the Bair Hugger was wrapped around the  
12:51:46 17 back of the patient so that air cannot escape, and --

12:51:50 18 Q. Was it wrapped around the back or was it  
12:51:52 19 tucked in --

20 A. Both.

21 Q. -- underneath the pad?

22 A. Both.

12:51:55 23 Q. Well it can't be both. It's either one  
12:51:58 24 side's tucked under the pad, or it's wrapped  
12:52:00 25 underneath the patient.

12:52:01 1 A. Oh, no. I said wrapped around the back.

12:52:03 2 Q. When you say "wrapped around the back," what

12:52:05 3 do you mean?

12:52:06 4 A. It -- It was wrapped around the back of the

12:52:08 5 patient and then tucked in.

12:52:09 6 Q. Tucked in underneath the pad.

12:52:12 7 A. It was tucked in somewhere -- some part of

12:52:13 8 the bed.

12:52:13 9 Q. Okay.

12:52:14 10 A. I did not --

12:52:15 11 If I said it was tucked underneath the

12:52:17 12 patient, then that's a mistake.

12:52:19 13 Q. Okay. Fair enough.

12:52:20 14 A. That air clearly cannot vent beneath the

12:52:23 15 room -- or beneath the table. I'm sorry.

12:52:26 16 But let's talk about the other air. This

12:52:29 17 Bair Hugger blanket is a blanket with tubes, air

12:52:33 18 tubes, and when you inflate it and you put on the

12:52:37 19 cotton layer -- the cotton blanket and the drapes it

12:52:40 20 wraps around the arm. And the way it works is you

12:52:44 21 have very small jets of air that shoot out of those

12:52:47 22 tubes and they impact the skin right away. In fact

12:52:51 23 there's a connection between those tubes and the skin.

12:52:55 24 So what happens is you have a warm, almost stagnant

12:53:00 25 air space. Now we know hot air rises. Colloquially,

12:53:07        1 heat rises. So that stationary air now has to escape,  
12:53:11        2 and what it wants to do is it wants to rise. There is  
12:53:14        3 no reason to expect that that air would go down,  
12:53:22        4 vertically downwards, go underneath the drape and then  
12:53:25        5 come back up.

12:53:26                  6                  Here is an analogy I'd like to use. Let's  
12:53:28                  7 -- Let's pretend that this is a match. [Demonstrating  
12:53:31                  8 with the red pen.] And let's pretend this red part is  
12:53:35                  9 the flame. If I hold the match like this, hot air  
12:53:37                  10 rises. You see the flame go up, you see the soot, et  
12:53:42                  11 cetera. If I -- Even if the air was to be vented  
12:53:47                  12 downwards, which it's not, because it's vented against  
12:53:50                  13 the skin, what happens when I do this?  
12:53:54                  14 [Demonstrating.] The flame still rises, the smoke  
12:53:57                  15 still rises.

12:53:58                  16                  I cannot get a match to have a flame that  
12:54:03                  17 will go down vertically, somehow travel underneath the  
12:54:07                  18 drape and then come back up, and that's the basis.

12:54:12                  19                  Q. Do you really believe that?

12:54:14                  20                  A. I am certain of it.

12:54:15                  21                  Q. You're certain of it.

12:54:16                  22                  A. Absolutely.

12:54:17                  23                  Q. Hundred percent.

12:54:18                  24                  A. Scientists never say 100 percent. I would  
12:54:21                  25 say within a reasonable degree of engineering

12:54:25 1 certainty, yes.

12:54:27 2 Q. So if I put a -- 10 space heaters facing up  
12:54:36 3 five feet from the ceiling, okay, I turn them all on,  
12:54:40 4 are you telling me I'm not going to feel heat down  
12:54:42 5 here?

12:54:42 6 A. That's not what I said.

12:54:43 7 Q. Okay. So heat can actually go down;  
12:54:46 8 correct? Depending on if there's any insulation  
12:54:49 9 above, conservation of energy; correct? It's going to  
12:54:52 10 -- The hot air is going to start warming the air below  
12:54:55 11 and below and it's going to keep on going down until  
12:54:58 12 it reaches us, correct, in my -- in my hypothetical,  
12:55:00 13 in my example. "Yes" or "no"?

12:55:02 14 A. I cannot answer that --

12:55:03 15 Q. Okay.

12:55:03 16 A. -- with a "yes" or "no."

12:55:04 17 Q. If you can't answer "yes" or "no," that's  
12:55:06 18 fine. We'll move on.

12:55:07 19 A. No. I can answer it. I can't answer it  
12:55:09 20 with a "yes" or "no."

12:55:10 21 Q. Okay. Let's move on.

12:55:15 22 (Interruption by the videographer.)

12:55:16 23 MR. ASSAAD: Two minutes? One more  
12:55:17 24 question.

12:55:20 25 BY MR. ASSAAD:

12:55:21 1 Q. If hot air does get below the operating room  
12:55:26 2 table, you agree with me if the heat fills up  
12:55:32 3 underneath the operating room table, when it escapes  
12:55:34 4 the drape on the sides it's going to start rising;  
12:55:37 5 correct?

12:55:39 6 A. Your question --

12:55:40 7 MR. GOSS: Object to form.

12:55:41 8 A. -- is based on a faulty premise.

12:55:43 9 Q. Forget about the premise.

12:55:44 10 Just say if there's -- if there's heat  
12:55:46 11 underneath the operating room table to the point where  
12:55:48 12 when it escapes the drape it's -- the air is warmer  
12:55:51 13 than the ambient temperature, that air is going to  
12:55:54 14 rise; correct?

12:55:55 15 MR. GOSS: Same objection.

12:55:56 16 A. So if you had a perfectly insulated table --  
12:56:00 17 I mean, to have your hypothetical work you would have  
12:56:04 18 to have it perfectly insulated, you would have to  
12:56:07 19 allow the heat to build up, and that's not what  
12:56:09 20 happens.

12:56:09 21 Q. Okay. But if it does happen and it escapes  
12:56:12 22 out the side the air is going to rise; correct?

12:56:14 23 A. If you had a perfectly insulated space under  
12:56:18 24 the table and you didn't let any heat leave, and you  
12:56:22 25 put heat into that space until the entire air space

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12:56:26 1 was warm, then yes.

12:56:28 2 MR. ASSAAD: Okay. We can take a lunch

12:56:31 3 break.

12:56:32 4 THE REPORTER: Off the record, please.

12:56:33 5 (Luncheon recess taken at

6 approximately 12:56 p.m.)

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1 AFTERNOON SESSION

2 (Deposition reconvened at

3 approximately 1:49 p.m.)

4 (Mr. Bushnell joined the

13:29:26 5 proceedings.)

13:55:43 6 BY MR. ASSAAD:

13:55:47 7 Q. You ready to continue, Dr. Abraham?

13:55:49 8 A. Yes. Thank you.

13:55:51 9 Q. You understand the allegations by the

13:55:52 10 plaintiffs in this case; correct?

13:55:56 11 A. I understand generally that there is an

13:55:59 12 allegation that for -- the Bair Hugger may cause

13:56:03 13 infections.

13:56:04 14 Q. Or significantly increase the risk of

13:56:06 15 infection.

13:56:08 16 A. I -- I don't know the specific allegation

13:56:11 17 made in this case, so I -- so no.

13:56:15 18 Q. But you understand that for hip and knee

13:56:20 19 implant surgery, infections are a serious thing.

13:56:22 20 A. That's my understanding.

13:56:24 21 Q. And they could be deadly; correct?

13:56:25 22 A. That is my understanding.

13:56:28 23 Q. And you agree with me no matter what side

13:56:32 24 you're on, plaintiffs' side or the defense side, if --

13:56:35 25 if the Bair Hugger does cause an increase in hip and

13:56:39 1 knee implant infections that that's not a good thing.

13:56:47 2 MR. GOSS: Object to form.

13:56:49 3 A. I would agree.

13:56:50 4 Q. Okay. Because, you know, people -- if that

13:56:57 5 is the case, people's lives are at stake.

13:57:00 6 MR. GOSS: Same objection.

13:57:01 7 A. I agree.

13:57:02 8 Q. Okay. And in fact you once were quoted for

13:57:06 9 saying: In my research, people's lives are literally

13:57:09 10 at stake. There is very little room for error when

13:57:13 11 you're designing devices that will be implemented into

13:57:15 12 bodies or trying to remove pathogens from dirty water

13:57:18 13 that a village relies upon. I need the very best

13:57:21 14 students who I can depend on to recognize that while

13:57:24 15 engineering is fun, it is also deadly serious. Lauren

13:57:27 16 is such a student.

13:57:28 17 Do you remember making that quote?

13:57:30 18 A. Yes.

13:57:30 19 Q. Okay. So although engineering is fun, it

13:57:32 20 can be deadly serious; correct?

13:57:34 21 A. Yes.

13:57:35 22 Q. Okay. And we want to be for sure, we want

13:57:37 23 to be certain, when we formulate opinions, that

13:57:42 24 because the effect of these opinions could be -- have

13:57:47 25 detrimental effects on people, we need to be serious

13:57:51 1 about it; correct?

13:57:52 2 MR. GOSS: Object to form.

13:57:53 3 A. I agree.

13:57:54 4 Q. Okay.

13:57:56 5 MR. ASSAAD: Basis?

13:57:57 6 MR. GOSS: Effects of opinions could be

13:57:59 7 deadly?

13:58:00 8 MR. ASSAAD: Yeah.

13:58:01 9 Q. I mean, if your opinion in this case is, to

13:58:04 10 3M, that the Bair Hugger doesn't increase the risk of

13:58:08 11 surgical-site infections and it actually does, but 3M

13:58:12 12 relies upon it to keep it in the market or not make

13:58:16 13 any changes to the product, that could be a -- an

13:58:18 14 opinion that could cause serious harm; correct?

13:58:21 15 MR. GOSS: Object to form. You can answer

13:58:22 16 if you understand the question.

13:58:27 17 A. I'm --

13:58:28 18 Yes.

13:58:29 19 Q. Okay. Now -- And the --

13:58:35 20 And Lauren Vallez is the person you were

13:58:40 21 talking about earlier that is a -- is a co-author on

13:58:44 22 the article that was submitted and accepted for

13:58:46 23 publication regarding the 505 and 750; correct?

13:58:51 24 A. Yes.

13:58:52 25 Q. And you've published a lot with her;

13:58:53 1 correct?

13:58:54 2 A. Yes.

13:58:56 3 Q. Okay. And if I recall correctly, isn't she

13:58:58 4 off to California?

13:59:00 5 A. I believe that's true.

13:59:01 6 Q. Is she still in town, or has she left for

13:59:04 7 California?

13:59:05 8 A. I don't know.

13:59:05 9 Q. Okay. But she took a -- she's doing a Ph.D.

13:59:10 10 program, is it at Stanford?

13:59:12 11 A. That sounds correct.

13:59:13 12 Q. Okay. Speaking about Stanford, are you --

13:59:21 13 do you know, personally, Dr. Krishnan Mahesh?

13:59:32 14 A. No.

13:59:33 15 Q. You understand that he's a professor at the

13:59:34 16 University of Minnesota; correct?

13:59:37 17 A. If you present that, I have no reason to

13:59:40 18 doubt that.

13:59:41 19 Q. Okay. So you don't know that he came from

13:59:43 20 Stanford and was part of the Ph.D. students that

13:59:50 21 worked on the code that was used by Elghobashi?

13:59:53 22 A. I don't know that.

13:59:53 23 Q. Okay. Now we -- you mentioned before we

14:00:13 24 took up the lunch break that if air is coming on the

14:00:19 25 arm it's going to migrate up and come out the head and

14:00:22        1     neck. Do you recall that testimony?

14:00:24        2     A.     Yes.

14:00:25        3     Q.     Do you have any calculations that you

14:00:27        4     performed to support that assumption?

14:00:33        5     A.     Are you asking me do I have calculations to

14:00:36        6     support the idea that the air will rise?

14:00:40        7     Q.     No. That the air will come from the arm --

14:00:43        8     the air that's being blown on the end of the hand is

14:00:46        9     going to migrate up the arm and out the head and neck

14:00:50        10    of the patient.

14:00:52        11    A.     I have no calculations.

14:00:53        12    Q.     Okay.

14:00:54        13    A.     I have my experience in buoyant flow motion.

14:00:57        14    Q.     Okay. But you have no calculations;

14:00:59        15    correct?

14:00:59        16    A.     Correct.

14:01:00        17    Q.     Do you have any experimental testing to

14:01:03        18    indicate of such?

14:01:06        19    A.     There is experimental testing. Well that's

14:01:12        20    a complex answer, I'm going to give it a few ways.

14:01:15        21    I'm going to give the answer in a few ways.

14:01:18        22    I have experimental testing that shows the

14:01:21        23    air does not exhaust beneath the table.

14:01:23        24    Q.     And what testing was that?

14:01:25        25    A.     That was testing --

14:01:26 1 That was flow visualization testing done in  
14:01:29 2 the OR with the draping as used in a hip or knee  
14:01:35 3 replacement.

14:01:35 4 Q. When you say "flow visualization testing,"  
14:01:38 5 what device did you use?

14:01:39 6 A. The device we mentioned earlier in this  
14:01:41 7 deposition. I believe it's called a megasonic fog  
14:01:45 8 device.

14:01:46 9 Q. Okay.

14:01:46 10 A. Okay?

14:01:47 11 Q. So --

14:01:51 12 A. In addition to that my findings are  
14:01:54 13 corroborated by testing from Tom Kuehn, and by  
14:01:54 14 literature that the plaintiffs rely upon.

14:01:57 15 Q. Okay. But I'm talking about you yourself.  
14:02:00 16 Have you done any experimental testing,  
14:02:02 17 besides using the fog generator, to support your  
14:02:08 18 assumption that all the air, even the air coming --  
14:02:11 19 hitting the end of the hand, is going to migrate up  
14:02:14 20 out of the head and neck?

14:02:15 21 A. No.

14:02:16 22 Q. Okay. In your analysis does the temperature  
14:02:37 23 underneath the operating room table increase in  
14:02:40 24 temperature?

14:02:40 25 A. Temperature does not increase temperature.

14:02:44 1 Q. I'm saying does the temperature in -- I'm  
14:02:46 2 sorry.

14:02:46 3 Does the air underneath the operating room  
14:02:48 4 table increase in temperature?

14:02:53 5 A. I don't know -- I don't recall extracting  
14:02:56 6 that data point. I would presume it does. I would  
14:03:02 7 presume that the air underneath the operating table  
14:03:06 8 may increase, but I don't believe I presented that in  
14:03:08 9 this document, and I don't think I extracted that  
14:03:10 10 data.

14:03:10 11 Q. Can --

14:03:11 12 If I go to your TRN file, can I extract that  
14:03:15 13 data?

14:03:15 14 A. Yes.

14:03:17 15 Q. Okay. If it does increase in temperature,  
14:03:21 16 would that not indicate that hot air is blowing down?

14:03:25 17 A. Not necessarily.

14:03:26 18 Q. What would cause the increase in  
14:03:28 19 temperature?

14:03:29 20 A. Before I answer that can you tell me the  
14:03:30 21 increase in temperature of what?

14:03:32 22 Q. The air underneath the operating room table.

14:03:34 23 A. Okay. Thank you.

14:03:36 24 Q. Let's say two inches below the operating  
14:03:38 25 room table.

14:03:42 1 A. Air temperature --

14:03:46 2 Heat can get below the operating table a

14:03:48 3 number of different ways, in fact we mentioned this

14:03:51 4 earlier in this deposition. There are three modes of

14:03:54 5 heat transfer; conduction, convection and radiation.

14:03:59 6 So if I were to measure, let's say, the temperature

14:04:01 7 directly underneath the operating table, and if I were

14:04:05 8 to measure a temperature increase it could be by one

14:04:08 9 of those three mechanisms. It may be that air has

14:04:13 10 migrated under the table, it may be that that region

14:04:17 11 has been heated by conduction, or it may be that it's

14:04:21 12 been heated by radiation.

14:04:23 13 Q. Well we could agree in your model, since all

14:04:25 14 the solids or all the geometry's adiabatic, that area

14:04:30 15 cannot be created -- be heated up by conduction;

14:04:32 16 correct?

14:04:33 17 A. That is correct.

14:04:33 18 Q. And since it's adiabatic it can't be --

14:04:37 19 there's no convective heat that's being transferred to

14:04:39 20 that, correct, through the table.

14:04:41 21 A. Convection would not refer to heat transfers

14:04:44 22 through the table.

14:04:45 23 Q. Okay. And there's no radiative heat that

14:04:47 24 would warm up underneath the operating room table

14:04:50 25 because the table is adiabatic.

14:04:52 1 A. That is correct.

14:04:53 2 Q. Okay. So let's go --

14:04:58 3 So how long did your model run to get to 264

14:05:06 4 step -- time step?

14:05:11 5 A. Sitting here now I don't know the answer to

14:05:12 6 that.

14:05:13 7 Q. But if we go to the TRN file that's

14:05:15 8 something we could determine?

14:05:16 9 A. Yes.

14:05:16 10 Q. Okay. And we could do that based on the

14:05:18 11 time step; correct?

14:05:20 12 A. It would be information contained within the

14:05:22 13 TRN file.

14:05:22 14 Q. If you did change the time step between time

14:05:26 15 zero and time step 264, would you have increased or

14:05:31 16 decreased the time step?

14:05:33 17 A. I don't know.

14:05:35 18 Q. So sitting here today we will never be able

14:05:38 19 to know that answer; correct?

14:05:49 20 A. Sitting here today, I don't know if or

14:05:52 21 whether I increased or decreased the time step.

14:05:56 22 Q. And if you did increase the time step you

14:06:00 23 wouldn't know if you increased it or decreased it.

14:06:02 24 A. That is correct.

14:06:02 25 Q. Okay. So sitting here today we could not

14:06:04 1 replicate that in ANSYS.

14:06:09 2 A. That is incorrect.

14:06:11 3 Q. Well how am I supposed to know the time step

14:06:13 4 if you don't know the time step?

14:06:15 5 A. When we use the word "replicate" in CFD,

14:06:18 6 what we mean is can you reproduce the results. Anyone

14:06:23 7 with my TRN file could reproduce my results, whether

14:06:27 8 or not they used the same time step or a different

14:06:30 9 time step, provided it was sufficiently small. So the

14:06:34 10 TRN file is all that you need to reproduce the

14:06:37 11 results.

14:06:37 12 Q. When you say "sufficiently small," what do

14:06:40 13 you mean by "sufficiently small"?

14:06:42 14 A. It has to be small enough so that the size

14:06:45 15 of the time step does not affect the results.

14:06:47 16 Q. Okay. In the beginning of running a model

14:06:49 17 do you want a large time step or a small time step for

14:06:52 18 a model such as this?

14:06:54 19 A. I prefer a small time step.

14:06:55 20 Q. Okay. And what would you consider small?

14:07:02 21 A. Less than a second.

14:07:04 22 Q. What about less than a tenth of a second?

14:07:08 23 A. Likely less than a tenth of a second.

14:07:11 24 Q. So if I represent to you that your TRN files

14:07:14 25 says .01 seconds, would you disagree with that?

14:07:18 1 A. I would not disagree with that.

14:07:19 2 Q. Is that something that you would likely do

14:07:21 3 for a time step in a situa -- in a model such as this?

14:07:25 4 A. It seems reasonable.

14:07:26 5 Q. Okay. Having the fact that it was .01 --

14:07:36 6 Well let me ask you this: How would you

14:07:39 7 know that the time step you used didn't affect the

14:07:41 8 model?

14:07:43 9 A. You'd run the calculation, as I said before,

14:07:46 10 and obtain quasi-steady results, and once your results

14:07:50 11 were quasi steady and you abide by certain rules of

14:07:54 12 the numerics, such as the Courant number has to be low

14:07:58 13 enough, you would assume that the results are

14:08:01 14 time-step independent.

14:08:02 15 Q. You used the word "Courant number"; correct?

14:08:06 16 A. Correct.

14:08:06 17 Q. And have you heard the term "CFL" number?

14:08:11 18 Are you familiar with that?

14:08:13 19 A. "CFL number"?

14:08:14 20 Q. Yes.

14:08:19 21 A. It doesn't --

14:08:24 22 I've heard "CFL." I can't place it right

14:08:26 23 now.

14:08:26 24 Q. So you've never heard of the

14:08:29 25 Courant-Friedrichs-Lowy number?

14:08:33 1 A. That's probably the same thing as the  
14:08:34 2 Courant number I was mentioning.  
14:08:36 3 Q. Well do you think it's the same number, or  
14:08:37 4 is it something similar to that number?  
14:08:39 5 A. I think it's the same number, --  
6 Q. Okay.  
14:08:41 7 A. -- but I would have to check the --  
8 Q. Okay.  
14:08:44 9 A. -- whatever resource to verify.  
14:08:46 10 Q. Now you mentioned earlier that --  
14:08:50 11 Well let me ask you this question: Is the  
14:08:52 12 mesh that you used in the TRN file the mesh you put in  
14:08:55 13 Figure 2 on page 4?  
14:09:07 14 A. I think it is.  
14:09:08 15 Q. Okay. Well do you know one way or the  
14:09:11 16 other?  
14:09:11 17 A. No.  
14:09:11 18 Q. Okay. Well how would you formulate this  
14:09:13 19 mesh for your report if it did not come from the TRN  
14:09:18 20 file?  
14:09:18 21 A. It is likely it is from the TRN file.  
14:09:21 22 Q. Okay. So you believe that your mesh in the  
14:09:24 23 TRN file is as fine as it's in this -- depicted in  
14:09:28 24 Figure 2.  
14:09:33 25 A. I don't recall if this image was taken from

14:09:36 1 the TRN file, so I can't answer that "yes" or "no."

14:09:39 2 Q. Well where would this image be taken from?

14:09:44 3 A. As noted in this report, calculations were

14:09:48 4 done for an 8.1 million-element mesh, and a mesh that

14:09:54 5 was approximately 60 million.

14:09:55 6 Q. So you did calculations for a 60 million

14:09:58 7 mesh?

14:09:59 8 A. That's correct.

14:09:59 9 Q. And are the results in this report?

14:10:01 10 A. No.

14:10:01 11 Q. Why not? Did it --

14:10:03 12 Did it converge?

14:10:04 13 A. Yes.

14:10:05 14 Q. And you've gotten results?

14:10:07 15 A. Correct.

14:10:07 16 Q. Why didn't you produce those results?

14:10:09 17 A. Because the results were the same, and it's

14:10:12 18 our practice in computational fluid dynamics to show

14:10:16 19 that your results are independent of mesh and then to

14:10:18 20 show one set of results.

14:10:20 21 Q. So my understanding is the calculations for

14:10:25 22 the six -- the 60-million-grid mesh no longer exist.

14:10:32 23 A. I don't know if they exist.

14:10:34 24 Q. Okay. How long did it take you to calculate

14:10:37 25 the 60-million-grid mesh?

14:10:41 1 A. I don't know.

14:10:42 2 Q. Was it done --

14:10:45 3 When was it done?

14:10:46 4 A. It would have been done about the same time

14:10:49 5 that the initial calculations were done. We have that

14:10:52 6 list of the time stamp, which I think was November

14:10:56 7 2015, so approximately then.

14:10:58 8 Q. Okay. Was it done in LES or RANS?

14:11:01 9 A. I believe it was LES.

14:11:03 10 Q. Okay. So -- And what was the time step --

14:11:08 11 step?

14:11:08 12 A. I don't recall.

14:11:10 13 Q. Would it have been less than a second?

14:11:12 14 A. I'm pretty sure it would have been less than

14:11:13 15 a second, but I don't recall.

14:11:14 16 Q. Okay. So it's your testimony today that --

14:11:19 17 Well how long did it take to run?

14:11:20 18 A. I don't recall.

14:11:21 19 Q. A month, two months, five months?

14:11:24 20 A. Well not five months, but I don't recall how

14:11:26 21 long it took.

14:11:26 22 Q. Can you give me an approximation?

14:11:28 23 A. No.

14:11:29 24 Q. Less than three months?

14:11:31 25 A. I don't know.

14:11:32 1 Q. Okay. So it's your --  
14:11:36 2 Well, so less than five; correct?  
14:11:38 3 A. Yes.  
14:11:39 4 Q. Greater than a month?  
14:11:40 5 A. I can't say.  
14:11:41 6 Q. Okay. And what computer did you do it on?  
14:11:44 7 A. A St. Thomas computer.  
14:11:46 8 Q. A 16-core computer?  
14:11:47 9 A. Yes.  
14:11:48 10 Q. How long do you think it would take for a  
14:11:50 11 16-core computer to run an LES mesh with 60 million  
14:11:54 12 cells?  
14:11:55 13 A. Depends on how long you run it. It depends  
14:11:56 14 on how many time steps.  
14:11:58 15 Q. Well how long did --  
14:11:59 16 A. What we -- Hold on.  
14:12:00 17 Sorry. That was inappropriate for me to say  
14:12:02 18 "hold on." I apologize.  
14:12:03 19 In computational fluid mechanics what a  
14:12:11 20 standard practice is to run code on more than one mesh  
14:12:17 21 to show that the results -- the conclusions don't  
14:12:20 22 depend on the mesh.  
14:12:22 23 Q. Called mesh independence; correct?  
14:12:24 24 A. That's correct.  
14:12:25 25 Q. How'd you perform your mesh independence?

14:12:28 1 A. Visualization of streamlines.

14:12:30 2 Q. Okay. So you'd done a mesh for eight

14:12:33 3 thousand one hundred or whatever it -- eight million

14:12:35 4 one -- eight million one hundred thousand; correct?

14:12:36 5 A. Correct.

14:12:36 6 Q. And you did one for approximately 60

14:12:38 7 million.

14:12:38 8 A. Correct.

14:12:39 9 Q. Exactly how many cells were used?

14:12:43 10 A. I don't recall the exact number, sitting

14:12:45 11 here.

14:12:46 12 Q. Okay. And do you know what shapes were used

14:12:52 13 in the approximate 60-million-cell mesh?

14:12:59 14 A. Yes.

14:13:00 15 Q. What?

14:13:01 16 A. The same shapes that were used in the

14:13:03 17 8.1-million-cell mesh.

14:13:05 18 Q. So the tetrahedras.

14:13:06 19 A. And pyramid.

14:13:07 20 Q. Okay. Well if I show you your ANSYS program

14:13:10 21 today and there's no mention of any pyramid shapes,

14:13:12 22 would you disagree with that?

14:13:14 23 A. No.

14:13:14 24 Q. Okay. So you're not absolutely certain that

14:13:17 25 there are pyramid shapes in your mesh.

14:13:20 1 A. I believe there are. It would not surprise  
14:13:22 2 me if the entire mesh was tetrahedral.

14:13:26 3 Q. Okay. So would you agree with me that the  
14:13:41 4 mesh that's used in Figure 2 is most likely the mesh  
14:13:46 5 used for your 60-million-cell mesh?

14:13:50 6 A. I would say I don't recall which one it is.

14:13:53 7 Q. Okay. And your mesh independence was solely  
14:14:07 8 based on the streamlines.

14:14:11 9 A. Correct.

14:14:13 10 Q. Okay.

14:14:13 11 A. It was based on the trajectory of the fluid  
14:14:15 12 flow in the room.

14:14:16 13 Q. Which create the streamlines.

14:14:17 14 A. Correct.

14:14:18 15 Q. Okay. Did you do path lines?

14:14:20 16 A. I did not.

14:14:21 17 Q. Okay. And we could agree that you did not  
14:14:23 18 add particles to the flow; correct?

14:14:25 19 A. Correct. It was unnecessary.

14:14:27 20 Q. Well I understand you believe it's  
14:14:28 21 unnecessary, but you don't have to -- I'm just asking  
14:14:31 22 you correct or not. I don't need -- If I want a  
14:14:33 23 reason, I'll ask you for a reason.

14:14:34 24 So you agree with me you didn't add  
14:14:36 25 particles to the flow; correct?

14:14:37 1 A. I did not.

14:14:38 2 Q. Did you change the geometry between the

14:14:40 3 8-million-cell mesh and the 60-million-cell mesh?

14:14:47 4 A. Yes.

14:14:47 5 Q. How did you change the geometry?

14:14:53 6 A. In the 60-million-cell mesh we actually

14:14:56 7 extended the geometry into the vents, the outlet

14:15:03 8 vents. And in the 8-million-cell mesh we did not.

14:15:07 9 Q. So in the 8-million-cell mesh you removed

14:15:09 10 the vents; correct?

14:15:11 11 A. In the 8-million-cell mesh we represented

14:15:13 12 the vents on the wall, and in the 60-million-cell mesh

14:15:18 13 we actually extended the solution up into the exhaust

14:15:22 14 vents --

14:15:22 15 Q. Okay.

14:15:22 16 A. -- so that would be into the wall.

14:15:23 17 Q. Okay. In your meshing, what algorithm did

14:15:38 18 you use?

14:15:42 19 A. I think I used a tetrahedral-based

14:15:50 20 algorithm, but I don't recall.

14:16:01 21 Q. Was it patch conformal or patch

14:16:03 22 non-conformal?

14:16:05 23 A. I don't recall.

14:16:06 24 Q. Is there any way to determine that today?

14:16:08 25 A. Not today.

14:16:09 1 Q. How? How would I determine that?

14:16:12 2 A. You -- From the TRN.

14:16:12 3 Q. So that would be in the TRN file?

14:16:14 4 A. Correct.

14:16:14 5 Q. Okay. Were any mesh controls used?

14:16:31 6 A. Sizing controls were used.

14:16:34 7 Q. Anything else?

14:16:36 8 A. Curvature controls were probably used,

14:16:40 9 sitting here now I don't know for sure; and proximity

14:16:43 10 controls were probably used, sitting here now, I don't

14:16:46 11 know for sure.

14:16:50 12 Q. So mesh controls would have curvature and

14:16:53 13 proximity values you could add to it?

14:16:57 14 A. That is correct.

14:17:02 15 Q. Did you use any defeaturig tools?

14:17:06 16 A. I defeatured manually. When we talked

14:17:09 17 earlier today about removing small features, that was

14:17:12 18 a manual defeaturig.

14:17:14 19 Q. Did you make --

14:17:15 20 Did you change any features of the drape?

14:17:17 21 A. No.

14:17:18 22 Q. Did you change any features of the patient?

14:17:21 23 A. No.

14:17:22 24 Q. Okay. And how'd you determine the quality

14:17:28 25 of your mesh?

14:17:33 1 A. I determined the quality of the mesh by the  
14:17:36 2 fact that the solution -- the results were independent  
14:17:40 3 of the mesh, and that's the ultimate arbiter of  
14:17:43 4 whether the mesh is a good quality.

14:17:44 5 Q. Now was the only thing that was changed  
14:17:46 6 between -- Well, strike that.

14:17:47 7 We agree that we changed -- you changed the  
14:17:50 8 geometry between the 8.1-million-cell mesh and the  
14:17:53 9 60-million-cell mesh; correct?

14:17:55 10 A. Correct.

14:17:55 11 Q. Okay. Was the only geometry changed the  
14:18:04 12 vents, exhaust vents?

14:18:06 13 A. That's the only thing I can recall now.

14:18:08 14 Q. Okay. Everything else was kept the same?

14:18:10 15 A. To my recollection, yes.

14:18:12 16 Q. Okay. Is it the same equations, used  
14:18:17 17 Boussinesq?

14:18:18 18 A. I believe that's true, yes. Same equations.

14:18:21 19 Q. Okay. So just so I understand, your  
14:19:05 20 determination of the mesh quality was solely based on  
14:19:09 21 doing the mesh-independence test between the 8.1  
14:19:16 22 million cells and the 60 million cells.

14:19:19 23 A. That is the gold standard for determining  
14:19:23 24 mesh quality, and yes, that's the method I used.

14:19:27 25 Q. Okay. Is the standard practice with respect

14:19:30 1 to mesh independence to change the geometry?

14:19:39 2 A. The geometry --

14:19:40 3 If the geometry materially impacts the

14:19:43 4 results, then no.

14:19:45 5 Q. So why did you change the geometry?

14:19:47 6 A. Because it was a defeaturing, as we

14:19:49 7 mentioned. I defeatured the presence or absence of

14:19:55 8 these vents. The ducts extended into the wall doesn't

14:19:58 9 matter. So in my judgment there was no reason to

14:20:02 10 calculate the flow up into the wall, so they were

14:20:04 11 removed.

14:20:05 12 Q. And that was for the 8.1 million cells.

14:20:07 13 A. Correct.

14:20:08 14 Q. Okay. But you thought it was necessary for

14:20:10 15 the 60 million cells?

14:20:13 16 A. No. It was probably not necessary for the

14:20:14 17 60 million cells.

14:20:15 18 Q. Which one did you run first, the 60 million

14:20:18 19 or the 8.1 million?

14:20:19 20 A. I don't recall.

14:20:28 21 Q. What metrics did you use to check the mesh,

14:20:31 22 besides grid independence?

14:20:34 23 A. I may have looked at --

14:20:37 24 I may have looked at shape quality, such as

14:20:41 25 skewness or orthogonality, but in my experience those

14:20:45 1 are not important for determining the mesh quality for  
14:20:48 2 a solution, so I relied upon a comparison of the  
14:20:51 3 results, mesh independence.

14:20:53 4 Q. Okay. So sitting here today if I asked you  
14:20:55 5 what the aspect ratio was, or the skewness, or the  
14:20:58 6 expansion ratio, you wouldn't know.

14:20:59 7 A. I would not know, and it's immaterial.

14:21:02 8 Q. I understand you think it's immaterial.

14:21:03 9 That's your opinion.

14:21:04 10 So the answer to the question is you would  
14:21:06 11 not know sitting here today.

14:21:07 12 MR. GOSS: All right. Wait for him to ask  
14:21:08 13 a question.

14:21:09 14 Q. You don't know the answers to the skewness,  
14:21:12 15 aspect ratio or expansion ratio sitting here today;  
14:21:15 16 correct?

14:21:15 17 A. Correct.

14:21:21 18 Q. Okay. So do you know if your aspect  
14:21:23 19 ratio -- it could have been anywhere from .1 to 15,  
14:21:26 20 you wouldn't know.

14:21:27 21 A. I don't know the aspect ratio.

14:21:29 22 Q. Okay. Do you know whether or not the Bair  
14:22:01 23 Hugger created any areas of turbulence in the  
14:22:04 24 operating room when you ran it?

14:22:12 25 A. Yes.

14:22:13 1 Q. Where?

14:22:17 2 A. Whenever you have rising buoyant flow into a

14:22:22 3 larger space you almost always have turbulence.

14:22:26 4 Q. I understand that.

14:22:26 5 My question was where in the operating room.

14:22:29 6 A. So places where we have rising heated flow

14:22:34 7 in this simulation are places where you would have

14:22:38 8 turbulence, and that would clearly be shown on Figure

14:22:50 9 11.

14:22:53 10 Q. Okay. Is Figure 11 the temperature

14:22:57 11 distribution of the room?

14:22:59 12 A. Yes.

14:23:00 13 Q. Okay. At a -- At time step 264; correct?

14:23:06 14 A. Correct.

14:23:07 15 Q. Okay. Now --

14:24:21 16 Going back to time step. If you ra -- If

14:24:30 17 there is only 264 time steps, would that -- would I be

14:24:34 18 able to calculate how long you let the model run?

14:24:39 19 A. Do you mean the computer time?

14:24:40 20 Q. No. Like how long it took from the initial

14:24:45 21 conditions to time step 264.

14:24:50 22 A. I believe you would be able to determine

14:24:52 23 that from the TRN.

14:24:53 24 Q. Okay. So if the TRN for 264 -- And I'm

14:24:58 25 talking about simulation time. You understand when I

14:25:00 1 say "simulation time"?

14:25:01 2 A. Yes.

14:25:02 3 Q. I mean, a one-second simulation could take a

14:25:04 4 week on the computer.

14:25:05 5 A. Correct.

14:25:06 6 Q. Okay. So if the time step that you used was

14:25:11 7 .01, then I would multiply that by 264 to get the

14:25:16 8 actual time of simulation?

14:25:19 9 A. If the time steps for those first 264

14:25:23 10 calculations was the same, then correct.

14:25:26 11 Q. Okay. Do you have any reason to believe

14:25:33 12 that you changed the time step between time step zero

14:25:36 13 and time step 264?

14:25:40 14 A. Sitting here now, no.

14:25:42 15 Q. Okay. So if the time step is 264, then the

14:26:06 16 model would have ran for 2 -- the simulation would

14:26:09 17 have ran for 2.64 seconds; correct?

14:26:12 18 A. Correct.

14:26:13 19 Q. And at that point you determined that, based

14:26:16 20 on the instantaneous velocity measurements of the

14:26:21 21 model, that you had quasi-static results.

14:26:27 22 A. Correct.

14:26:28 23 Q. Okay. Did you start the model at time zero?

14:26:41 24 A. Yes.

14:26:50 25 Q. Is it possible that you used a time step

14:26:53 1 before 264 of .001 seconds?

14:27:00 2 A. It is possible.

14:27:00 3 Q. And if that's the case, then it would be

14:27:02 4 less than 2.64 seconds for the simulation; correct?

14:27:05 5 A. Correct.

14:27:06 6 Q. Okay. Do you --

14:27:11 7 Do you set the time step change prior to

14:27:17 8 starting the model run, or can you change it in the

14:27:20 9 middle of a run?

14:27:21 10 A. You can change it in the middle of a run.

14:27:23 11 Q. Okay. And you said the run for the -- for

14:27:25 12 the 8.1 million model took 40 days.

14:27:29 13 A. Yes.

14:27:30 14 Q. Okay. And it took 40 days to get 264 time

14:27:35 15 steps?

14:27:37 16 A. Well remember I have a file at 300, --

14:27:41 17 Q. Okay.

14:27:42 18 A. -- so I went beyond 264. I don't recall how

14:27:45 19 far I went, but it took 40 days to do the calculation.

14:27:51 20 Q. I understand that. And you think -- It

14:27:53 21 could be 300, it could be 264, you don't know.

14:27:56 22 A. Correct.

14:27:56 23 Q. Okay. And you said this report was done by

14:28:11 24 Science Day; correct?

14:28:12 25 MR. GOSS: Object to form.

14:28:13 1 Q. All the pictures and the meshes and  
14:28:15 2 everything.

14:28:16 3 A. Boy, I think it was. I think all of these  
14:28:18 4 were done by Science Day.

14:28:44 5 Q. You said previously today that you ran  
14:28:47 6 through 2500 time steps; correct?

14:28:51 7 A. The 505 results include the 2540 time step  
14:28:57 8 result.

14:28:58 9 Q. Okay. How many time steps did you run for  
14:28:59 10 the 750?

14:29:01 11 A. I don't know.

14:29:02 12 Q. Okay. But it wasn't 2500.

14:29:04 13 A. Correct.

14:29:05 14 Q. Okay. Then I misunderstood you.  
14:29:06 15 I thought we were talking about the 750.

14:29:11 16 A. The 2500 pertained to the --

14:29:15 17 Q. 505.

14:29:16 18 A. -- 505.

14:29:17 19 Q. And that's why we have a file named 2540  
14:29:20 20 TRN.

14:29:20 21 A. Correct.

14:29:21 22 Q. Okay. And you believe that there is a time  
14:29:34 23 step 300 that was --

14:29:35 24 Well let me ask you this: Can you preset  
14:29:38 25 the amount of time steps you want in a model?

14:29:42 1 A. Yes.

14:29:43 2 Q. Did you do that in this -- in the 750 case?

14:29:46 3 A. No.

14:29:47 4 Q. So you just ran it till you believed you had

14:29:49 5 a solution.

14:29:49 6 A. Correct.

14:29:51 7 Q. Till you had convergence.

14:29:52 8 A. Till I had a quasi-steady solution.

14:29:55 9 Q. Okay. Now you'll agree with me that if your

14:30:01 10 boundary conditions are not correct, the model's not

14:30:03 11 correct.

14:30:06 12 A. If your boundary conditions differ in a way

14:30:10 13 that's substantive --

14:30:13 14 Let me put it this way: The software solves

14:30:16 15 the problem for the boundary conditions. If the

14:30:18 16 boundary conditions that you put into the software

14:30:23 17 differ significantly from the actual boundary

14:30:25 18 conditions then I agree, the solution will not reflect

14:30:28 19 reality.

14:30:28 20 Q. So if your boundary condition's different

14:30:30 21 from the actual, real-life conditions, then the model

14:30:35 22 will not be accurate.

14:30:36 23 A. If the difference is significant.

14:30:39 24 Q. Okay. And you criticize Elghobashi on a

14:30:48 25 number of things, but one of them is his boundary

14:30:50 1 conditions; correct?

14:30:51 2 A. That is correct.

14:30:51 3 Q. And that's why you say he's incorrect;

14:30:54 4 right?

14:30:54 5 A. That is one of the reasons.

14:30:55 6 Q. Okay. And so therefore if your boundary

14:30:58 7 conditions are incorrect, then your analysis would be

14:31:01 8 incorrect; correct?

14:31:03 9 A. If the difference between my boundary

14:31:05 10 conditions and the correct boundary conditions is

14:31:07 11 significant, then yes, I agree with you.

14:31:10 12 Q. For example, if none of the air comes out

14:31:12 13 the head and neck but goes below the operating room

14:31:16 14 table, then -- and that -- and you are incorrect in

14:31:19 15 that assumption, then your model would be incorrect.

14:31:21 16 True?

14:31:22 17 MR. GOSS: Object to form, improper

14:31:23 18 hypothetical.

14:31:23 19 A. I would say this. My model has a boundary

14:31:29 20 condition where the air leaves through the head and

14:31:32 21 neck area into the room. I do not have a boundary

14:31:36 22 condition like Elghobashi where the air leaves at the

14:31:38 23 bottom of the drape and then into a room. I would

14:31:40 24 call that a significant difference.

14:31:42 25 Q. Okay.

14:31:42 1 A. If his boundary conditions are correct and  
14:31:45 2 if mine are incorrect, then that would cause me  
14:31:51 3 concern that my results are not correct.

14:31:53 4 Q. Well from an experienced computational fluid  
14:31:59 5 dynamics engineer, you would agree with me that the  
14:32:02 6 results of the TRN file that we're looking at in this  
14:32:05 7 case would not depict what would occur if the air was  
14:32:10 8 going underneath the operating room table and not out  
14:32:13 9 the head and neck; correct?

14:32:15 10 A. We have to be very careful and exact in our  
14:32:17 11 words.

14:32:17 12 If the air left the bottom of the drape and  
14:32:25 13 oozed uniformly from the drape into the room, as Dr.  
14:32:29 14 Elghobashi assumed, that would be a very different  
14:32:32 15 boundary condition than the one I used. And if he is  
14:32:38 16 correct, then I have great concern about my  
14:32:41 17 calculations.

14:32:41 18 Now if the air is exhausted, let's say along  
14:32:47 19 the arm, maybe under the table, but then still exits  
14:32:51 20 by the head and neck, then I am much less concerned.

14:32:54 21 Q. Okay. Well when you say "greatly  
14:32:58 22 concerned," it would question your reliability in your  
14:33:02 23 results; correct?

14:33:02 24 A. Yes.

14:33:03 25 Q. And you couldn't sit here today and say that

14:33:05        1 my results are correct and reliable because of these  
14:33:08        2 great concerns.

14:33:09        3              A.     Correct.

14:33:10        4              Q.     Okay. How do you determine if a difference  
14:33:15        5 is significant?

14:33:19        6              A.     One way to determine it is to run both cases  
14:33:23        7 and to compare the results. That's probably the most  
14:33:26        8 direct way.

14:33:28        9              Q.     Okay. And it's quite clear that your  
14:33:31        10 results are much different than Elghobashi's results;  
14:33:33        11 correct?

14:33:36        12             A.     Correct.

14:33:37        13             Q.     But with respect to your analysis, you did  
14:33:44        14 not -- you did not analyze particle flow; correct?

14:33:49        15             A.     It was unnecessary.

14:33:50        16             Q.     That wasn't my answer -- my question.

14:33:52        17             You did not analyze particle flow; correct?

14:33:55        18             A.     Correct.

14:33:57        19             Q.     Okay. Now you formulated your assumptions  
14:34:14        20 back in 2015; correct?

14:34:20        21             A.     Yes.

14:34:21        22             Q.     That was before any of the depositions in  
14:34:23        23 this MDL; correct?

14:34:26        24             A.     Correct.

14:34:27        25             Q.     Before any of these expert witnesses were

14:34:30 1 identified in written reports.

14:34:33 2 A. Correct.

14:34:34 3 Q. Okay. Before any --

14:34:44 4 Let me ask you this. Did anyone at 3M

14:34:48 5 indicate to you that all the air comes from the head

14:34:50 6 and neck?

14:34:51 7 A. No.

14:34:52 8 Q. Okay. Did you see any 3M testing that

14:34:54 9 stated the opposite?

14:34:56 10 A. No.

14:34:57 11 Q. If they had actual testing done that

14:35:00 12 indicated that -- that not all the air comes out of

14:35:05 13 the head and neck, but most of it goes down -- from

14:35:09 14 the arm section down below, would that change your

14:35:11 15 opinions in this case?

14:35:12 16 A. I would need to see the --

14:35:13 17 MR. GOSS: Object to form.

14:35:14 18 A. -- details of the tests.

14:35:15 19 Q. Okay.

14:35:16 20 A. It's possible.

14:35:45 21 Q. You would agree with me that if you only ran

14:35:49 22 your model for 2.5 seconds, roughly, that although you

14:35:59 23 may be able to get changes -- determine quasi-static

14:36:06 24 solution for a velocity, you could not apply that to a

14:36:12 25 change in temperature in the operating room. True?

14:36:15 1 A. I disagree.

14:36:16 2 Q. You disagree. Why?

14:36:22 3 A. Remember you have to have initial conditions

14:36:26 4 to start, and if your initial conditions are very good

14:36:31 5 you can be very close to a quasi-steady result from

14:36:35 6 time zero, and that's the whole point of setting good

14:36:38 7 initial conditions.

14:36:39 8 Q. But you don't know what your initial

14:36:40 9 conditions are.

14:36:42 10 A. I -- Well I had reasonable initial -- I had

14:36:46 11 very good initial conditions.

14:36:47 12 Q. But sitting here today you do not know what

14:36:49 13 your initial conditions are; correct?

14:36:53 14 A. My initial conditions were almost identical

14:36:56 15 to the flow patterns that we see here, here

14:37:02 16 [indicating].

14:37:03 17 Q. Are you guessing?

14:37:04 18 A. No.

14:37:04 19 Q. So how do I -- how do I --

14:37:06 20 How do you prove that to me, by just stating

14:37:09 21 off the top of your head that your initial conditions

14:37:11 22 are here, equivalent to here, here, here, here and

14:37:16 23 here [indicating]?

14:37:16 24 MR. GOSS: Objection, move to strike,

14:37:19 25 mischaracterizes his testimony.

14:37:23 1 A. Well I'm under oath and I'm obligated to  
14:37:26 2 tell the truth, and so I'm presenting to you that  
14:37:31 3 these results were very similar to the initial  
14:37:34 4 conditions.

14:37:42 5 Q. So you believe the initial conditions in an  
14:37:45 6 operating room would show very little temperature  
14:37:55 7 gradient between the ceiling and the floor?

14:38:05 8 "Yes" or "no," or you don't know.

14:38:08 9 MR. GOSS: Take your time and give the  
14:38:09 10 answer to the best of your ability.

14:38:11 11 A. Can you re-ask the question?

14:38:13 12 Q. Based on Figure 11 the temperature gradient  
14:38:16 13 between the ceiling and the floor is constant. Do you  
14:38:22 14 believe that your initial conditions --  
14:38:24 15 Do you believe that the temperature gradient  
14:38:25 16 in an operating room would be constant from the  
14:38:29 17 ceiling, where the air is coming out of, to the floor?

14:38:33 18 A. Figure 11 does not show that.

14:38:40 19 Q. You're saying it's a different color from  
14:38:42 20 the ceiling and the floor?

14:38:44 21 A. Yes.

14:38:46 22 Q. How much of a difference?

14:38:48 23 A. Let me explain.

14:38:49 24 Q. I'm asking you a question. How much of a  
14:38:51 25 difference? You can look at the picture.

14:38:55 1 If you know. If you don't know, that's  
14:38:56 2 fine.  
  
14:38:58 3 A. You have in your possession, I believe, an  
14:39:04 4 image which shows the temperature gradient vertically  
14:39:06 5 in the room for the 505. This image --  
  
14:39:11 6 Q. 750, you mean.  
  
14:39:14 7 A. For the 505.  
  
14:39:19 8 Do you have any of the 505 results?  
  
14:39:22 9 Q. I'm not talking about the 505, I'm talking  
14:39:24 10 about the 750 here.  
  
14:39:25 11 A. I -- I know you are.  
  
14:39:29 12 Q. I did not look at the 505 results because  
14:39:32 13 they don't apply to this report.  
  
14:39:33 14 A. Okay. But had you looked at them, they  
14:39:35 15 showed the temperature variation vertically in a room  
14:39:38 16 and they -- the image that I used there was more  
14:39:40 17 appropriate to detect the temperature difference be --  
14:39:43 18 than this image, because this image is called what's  
14:39:46 19 -- what's called scaled globally. That means the  
14:39:50 20 hottest value in the entire room is red, the coldest  
14:39:54 21 value in the entire room is dark blue. I scaled it  
14:40:00 22 this way so that you could see the hot -- hot spots,  
14:40:03 23 any hot spots in the room.  
  
14:40:06 24 If I wanted to show the image that you've  
14:40:09 25 articulated -- by the way, which I have created -- I

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14:40:13        1    would have scaled it differently. I would have scaled  
14:40:15        2    it, for example, from 59 to maybe 70, and then the 70  
14:40:19        3    degree areas would be red.

14:40:22        4           So this image does not show that there is no  
14:40:25        5    temperature variation in a room. It is scaled to show  
14:40:28        6    the min and max range.

14:40:32        7           Q.    Okay.

14:40:33        8           A.    Okay?

14:40:34        9           Q.    What other images --

14:40:35        10          Do you have images that you've scaled it to  
14:40:39        11          a different range?

14:40:40        12          A.    Yes.

14:40:41        13          Q.    Have you provided that to counsel?

14:40:42        14          A.    Yes.

14:40:45        15          Q.    And that has not been provided to me.

14:40:47        16          So what other images have you created that  
14:40:48        17          you provided to counsel that's not in your report?

14:40:52        18          A.    Image --

14:40:52        19          MR. GOSS: I would just state for the  
14:40:53        20          record I'm not sure that it hasn't been provided.

14:41:00        21          But you can answer the question, if you  
14:41:03        22          can.

14:41:05        23          A.    I don't know what images have been provided  
14:41:06        24          by counsel, but I've done calculations with the 505.

14:41:12        25          Q.    I'm not talking about the 505, I'm talking

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14:41:14 1 about the 750. I don't care about the 505, that's not  
14:41:17 2 part of your report. Do you understand that, sir?  
14:41:19 3 A. Yes.  
14:41:20 4 Q. Okay. So with the 750 are there other  
14:41:24 5 images that show temperature gradients?  
14:41:26 6 A. Not that I'm aware of.  
14:41:28 7 Q. Okay. Did you use a sub-grid model for your  
14:42:05 8 -- for the LES?  
14:42:06 9 A. Yes.  
14:42:07 10 Q. What was the sub-grid model?  
14:42:09 11 A. The wall-adapted large-eddy model.  
14:42:12 12 Q. So W-A-L-E?  
14:42:14 13 A. Yes.  
14:42:16 14 Q. And any --  
14:42:17 15 And that was constant throughout your whole  
14:42:20 16 model; you didn't make any changes to that?  
14:42:23 17 A. Correct.  
14:42:23 18 Q. Okay. And you used Boussinesq?  
14:42:27 19 A. Yes.  
14:42:28 20 Q. Okay. And you agree with me that the  
14:42:35 21 temperature gradient on Figure 11 is from 105.9  
14:42:40 22 degrees to 59 degrees; correct?  
14:42:42 23 A. I disagree.  
14:42:50 24 Q. You have air coming out of the Bair Hugger  
14:42:52 25 at 105.9 degrees; correct?

14:42:54 1 A. Correct.

14:42:55 2 Q. Okay. So the temperature gradient in the

14:42:57 3 room is 105.9 to 59 -- 59 to 105.9; correct?

14:43:02 4 A. No, it is not.

14:43:03 5 Q. Why not?

14:43:04 6 A. Because the term "gradient" means a change

14:43:06 7 of something over a distance. Gradient is like

14:43:09 8 velocity.

14:43:11 9 What you're talking about is a temperature

14:43:13 10 difference, not a gradient.

14:43:15 11 Q. Okay. Lack of term.

14:43:16 12 Temperature difference is between 59 degrees

14:43:18 13 and 105.9 degrees.

14:43:20 14 A. Correct.

14:43:21 15 Q. Okay. And since --

14:43:41 16 You have the choice of using ideal gas in

14:43:44 17 ANSYS, or Boussinesq; correct?

14:43:46 18 A. That is correct.

14:43:47 19 Q. And you chose Boussinesq because it's

14:43:49 20 quicker computation; correct?

14:43:51 21 A. Incorrect.

14:43:52 22 Q. It's not?

14:43:52 23 Why did you use Boussinesq?

14:43:54 24 A. It is quicker, but I chose it because it

14:43:57 25 makes it a worst-case scenario. It stacks the cards

14:44:00 1 against 3M and so it's a worst-case scenario.

14:44:04 2 Q. How does it stack the cards against --

14:44:06 3 I mean, isn't the whole point of doing CFD

14:44:08 4 is to be as accurate as possible and to show exactly

14:44:12 5 what happens in a model that would happen in real

14:44:16 6 life?

14:44:16 7 A. Not necessarily.

14:44:17 8 Q. So is that not what you did here? Is this

14:44:20 9 -- Is what you did in your -- in your modeling what

14:44:23 10 happens in real life?

14:44:25 11 A. Let me explain.

14:44:26 12 Q. "Yes" or "no," then you could explain.

14:44:30 13 A. Yes.

14:44:31 14 Q. Okay.

14:44:33 15 A. When we do a calculation we have to make

14:44:38 16 choices, and we can make choices that are judgements,

14:44:43 17 and sometimes those judgements may affect the results

14:44:45 18 in small ways. What I like to do is do what's called

14:44:49 19 a bounding calculation. I like to assume worst-case

14:44:53 20 scenarios. If I assume a worst-case scenario against

14:44:59 21 the manufacturers of the Bair Hugger, and if I -- if

14:45:02 22 my results show that the air does not intrude to the

14:45:05 23 surgical site then I have added confidence that under

14:45:09 24 a more exact calculation the results would hold.

14:45:13 25 Q. Worst-case scenario you performed?

14:45:15 1 A. The Boussinesq --

14:45:17 2 Q. No. I'm saying you -- in all the

14:45:20 3 assumptions you made you determined the worst-case

14:45:22 4 scenario.

14:45:22 5 A. For the buoyancy model I did.

14:45:24 6 Q. Okay. You didn't --

14:45:26 7 You didn't assume it for where the air goes;

14:45:28 8 correct? The hot air.

14:45:33 9 A. Well that --

14:45:33 10 (Interruption by the reporter.)

14:45:34 11 A. When we make assumptions, we make

14:45:40 12 assumptions on things that we're uncertain about.

14:45:44 13 Things that -- Let me give you an example. The air

14:45:48 14 coming out of the blanket. It could be 41 Celsius, it

14:45:55 15 might be 33 Celsius. We don't know for sure. And in

14:45:59 16 fact you might have some air that's 33 and some air

14:46:02 17 that's 41, so there's a judgment that has to be made.

14:46:06 18 In those cases I tend to prefer judgements that stack

14:46:11 19 the cards against the case so that if my results come

14:46:16 20 out to show no intrusion, I have more confidence.

14:46:24 21 Q. By the way, in your report you said the war

14:46:29 22 -- on page 6 [5]: "The warm air from the Bair Hugger

14:46:32 23 blanket was treated as a second inlet to the room near

14:46:35 24 the patient's head and the temperature of the air

14:46:37 25 leaving the blower and entering the blanket was set to

14:46:40 1 the highest value of 43 degrees Celsius. This assumes  
14:46:45 2 a worst-case scenario; the temperature of the air  
14:46:48 3 exiting near the patient's head should be  
14:46:50 4 significantly less than 43 degrees Celsius -- the  
14:46:53 5 value used in these -- "the value used in these  
14:46:55 6 calculations was 43 degrees Celsius."

14:46:58 7 Correct?

14:47:02 8 A. You have read that correctly.

14:47:04 9 Q. Is that what you used, you used 43 or 41?

14:47:07 10 A. It's a typo. It should have been 41.

14:47:09 11 Q. Okay. Because 41 degrees is 106, not 43.

14:47:12 12 A. That's -- That's right.

14:47:14 13 Q. Okay. So that's a typo.

14:47:16 14 Any other typos I should be aware of?

14:47:18 15 A. Not that I know of.

14:47:19 16 Q. Okay. And now do you know what the

14:47:26 17 temperature of a human body is? I'm sure you do

14:47:28 18 because you've done studies on it.

14:47:29 19 A. Yes, I do.

14:47:30 20 Q. What's the skin temperature of a human body?

14:47:32 21 A. It depends on the environment that they're

14:47:34 22 in. If you're out here in Minnesota in the winter

14:47:38 23 your skin temperature is going to be colder than in

14:47:41 24 the summer. It also depends on the part of the body,

14:47:43 25 the face and nose and ears tend to be colder, but

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14:47:47 1 generally it's a few degrees colder than body core  
14:47:50 2 temperature. So in metric units maybe 34 degrees  
14:47:54 3 Celsius.  
14:47:54 4 Q. What about the core?  
14:47:55 5 A. The core is approximately 37.  
14:47:59 6 Q. Okay. Skin temperature, around the chest.  
14:48:01 7 A. No.  
14:48:02 8 Q. What about the skin around the -- like the  
14:48:04 9 chest and everything?  
14:48:05 10 A. It depends on the clothing that peoples wear  
14:48:08 11 -- people are wearing. I would estimate, sitting  
14:48:10 12 here, with a reasonable degree of certainty, between  
14:48:14 13 35 and 36.  
14:48:15 14 Q. Okay. So I'm a little bit confused, because  
14:48:20 15 heat transfer goes from something that's hot to  
14:48:26 16 something that's cold; correct?  
14:48:28 17 A. That is correct.  
14:48:28 18 Q. Okay. And I think that's --  
14:48:30 19 Is that the second law of thermodynamics?  
14:48:32 20 A. No.  
14:48:32 21 Q. Okay. Maybe I'm wrong.  
14:48:33 22 So are you aware of internal studies of 3M  
14:48:40 23 that actually measured the temperature underneath the  
14:48:45 24 blanket when it's being used?  
14:48:46 25 A. No.

14:48:47 1 Q. Why'd you come up with 41 degrees then?

14:48:50 2 A. I've studied these blankets for years. I've

14:48:54 3 studied 3M's blankets and other blankets. Through my

14:48:59 4 study know that when the air -- let's say the air

14:49:03 5 enters the blankets at 43 Celsius, it transfers heat

14:49:08 6 to the body and loses heat. It loses -- lowers its

14:49:12 7 temperature. As the air exit -- exits out the holes

14:49:16 8 it will be somewhat less than 43. Now in some parts

14:49:21 9 of the -- The blanket's not a uniform temperature. If

14:49:25 10 we were to lay a blanket out on this table and let's

14:49:28 11 say the hose entered here and the end of the blanket

14:49:33 12 was here, you would actually show a temperature

14:49:36 13 decrease as you went from one end to the other.

14:49:40 14 Q. Did you ask for 3M whether or not they have

14:49:42 15 measured the uniformity of their temperature under the

14:49:45 16 blankets?

14:49:45 17 A. I did not.

14:49:46 18 Q. Wouldn't that be something that would be

14:49:47 19 good to know?

14:49:48 20 A. Not necessary for my calculations.

14:49:50 21 Q. Okay. Well --

14:49:51 22 A. So what I did --

14:49:52 23 Q. You're making the assumption, sir, that the

14:49:54 24 air might be different at one part of the blanket or

14:49:56 25 the other. Is that based on any experiments done on

14:49:58        1     the Bair Hugger, or just an educated guess?

14:50:02        2     A.     It's based on experiments done on the Bair

14:50:04        3     Hugger.

14:50:04        4     Q.     What studies?

14:50:05        5     A.     I cannot tell you.

14:50:06        6     Q.     Well I'm sitting here today and I need to

14:50:09        7     know, so I can go back and check your credibility,

14:50:11        8     what studies you're referring to.

14:50:12        9           Is it listed in -- in any -- in your CV?

14:50:16        10    A.     No.

14:50:17        11    Q.     Okay. Is it studies you've done for 3M or

14:50:20        12    Arizant?

14:50:21        13    A.     No.

14:50:21        14    Q.     So what studies are they?

14:50:22        15    A.     Actually, let me take that back.

14:50:24        16    We did do studies in the 2000, 2002 period

14:50:31        17    where we measured temperature of air inside the Bair

14:50:33        18    Hugger, and there is clearly a temperature variation

14:50:36        19    as you move along the blanket.

14:50:41        20    So I made an engineering decision. I

14:50:44        21    decided to use the hottest reasonable temperature at

14:50:49        22    the exhaust because that would promote buoyant mixing.

14:51:02        23    (Abraham Exhibit 8 marked for

24                identification.)

25    BY MR. ASSAAD:

14:51:11 1 Q. Was assuming 41 degrees in 3M's favor --  
14:51:23 2 Was assuming 41 degrees in favor of 3M, or  
14:51:26 3 -- or an assumption made in favor of 3M, worst-case  
14:51:31 4 scenario?  
14:51:33 5 A. You've handed me a document --  
14:51:35 6 Q. That's a different question. I'm asking you  
14:51:36 7 a different question. I haven't got to this document  
14:51:38 8 yet.  
14:51:39 9 A. Okay.  
14:51:39 10 Q. Your assumption that 41 degrees is coming  
14:51:41 11 out of the blanket, was that in 3M's favor of creating  
14:51:45 12 a worst-case scenario?  
14:51:47 13 A. It was a worst-case scenario against 3M.  
14:51:50 14 Q. "Against 3M." Okay. All right.  
14:51:52 15 What's been marked as Exhibit Number 8 is a  
14:51:57 16 document produced during the litigation which is a  
14:52:00 17 data of measurements taken by the Bair Hugger 505, as  
14:52:04 18 well as the 750, used with different blankets -- with  
14:52:10 19 a upper body blanket, a new body blanket and an older  
14:52:13 20 body 522 blanket.  
14:52:15 21 Have you seen this document before?  
14:52:16 22 A. I do not recall seeing this document.  
14:52:17 23 Q. Okay. Do you see where it talks about MCST,  
14:52:20 24 the average of temperature across the blanket?  
14:52:23 25 A. Yes.

14:52:24 1 Q. And I'm going to tell you and I'm going to  
14:52:25 2 represent to you that what they do at 3 -- at Arizant  
14:52:28 3 at this time is they have a -- a bed with many  
14:52:31 4 thermocouples on it and they place the Bair Hugger and  
14:52:33 5 they check how much of the -- how much heat is coming  
14:52:36 6 out of the -- out of the holes onto the test bed.  
14:52:39 7 Have you ever heard of them doing that?  
14:52:41 8 MR. GOSS: The Bair Hugger blanket.  
14:52:42 9 MR. ASSAAD: Bair Hugger blanket.  
14:52:44 10 Q. Have you --  
14:52:44 11 Have you seen that test before?  
14:52:46 12 A. No.  
14:52:46 13 Q. Okay. Do you have any reason to believe  
14:52:48 14 that 3M or Arizant would incorrectly provide data in  
14:52:57 15 this case to the plaintiffs?  
14:52:59 16 MR. GOSS: Object to the lack of  
14:53:01 17 foundation.  
14:53:01 18 A. Could you repeat the question?  
14:53:02 19 Q. Withdraw that question, it was a bad  
14:53:03 20 question.  
14:53:04 21 Do you see here, under "Model 750 warming  
14:53:08 22 unit" that under "New (M9) 522," and I represent  
14:53:12 23 that's a new change in the Bair Hugger blanket, that  
14:53:15 24 the average temperature across the blanket is 41.1  
14:53:18 25 degrees?

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14:53:19 1 A. I see it says that, and I don't know what it  
14:53:22 2 -- what me -- what the meaning of "average temperature  
14:53:24 3 across the blanket" is.  
14:53:25 4 Q. Okay. Do you see where it says the standard  
14:53:28 5 deviation is .7?  
14:53:30 6 A. I see that.  
14:53:31 7 Q. Okay. So sitting here today you've never  
14:53:34 8 seen this document.  
14:53:35 9 A. I don't recall ever seeing this document.  
14:53:38 10 Q. Okay. Wouldn't it be --  
14:53:38 11 I mean, why recreate the wheel? Wouldn't it  
14:53:44 12 be just proper to ask 3M, hey, do you have any data on  
14:53:46 13 what the temperature is coming out of the blanket?  
14:53:50 14 A. Not necessary. I've got a lot of experience  
14:53:54 15 with these devices, so I trust my own judgment.  
14:53:56 16 Q. Do you have experience with the Bair Hugger  
14:53:57 17 blower 750 and the Model 522 blanket?  
14:54:05 18 A. I don't know.  
14:54:05 19 Q. Okay. Do you have any experience with the  
14:54:07 20 750 prior to this study?  
14:54:10 21 A. I don't --  
14:54:11 22 I would have to look to see what models I've  
14:54:13 23 studied.  
14:54:14 24 Q. Okay. So if you can't remember what you  
14:54:17 25 even studied, how do you have experience on what the

14:54:19        1 heat output and the airflow and the -- and what the  
14:54:23        2 temperature is coming out of the blanket if you can't  
14:54:26        3 even remember if you've even seen the device before?  
14:54:29        4            A. Because I've studied many of these blankets  
14:54:31        5 and they all have a very similar behavior. The flow  
14:54:35        6 enters into the blanket through a tube, typically the  
14:54:39        7 temperature at entry is 43 or 44 Celsius, there is a  
14:54:43        8 temperature drop as you move from one end to the other  
14:54:46        9 of the blanket. Regardless of which blanket you're  
14:54:49        10 studying, regardless of the manufacturer, regardless  
14:54:51        11 of the brand, there are those temperature variations.  
14:54:55        12            Q. But you don't know in this case.  
14:54:58        13            A. What's that?  
14:55:01        14            Q. You don't know in the 522 what the  
14:55:03        15 temperature difference is; do you?  
14:55:05        16            A. Which temperature difference are you talking  
14:55:07        17 about?  
14:55:09        18            Q. Across the blanket.  
14:55:11        19            A. But where across the blanket?  
14:55:13        20            Q. From -- From the hose where it's coming in  
14:55:16        21 at 43 degrees, and what's coming out of the  
14:55:18        22 perforations at the opposite end. You don't know what  
14:55:20        23 the change in -- the Delta T is; do you?  
14:55:22        24            A. No, but I can estimate it within a  
14:55:25        25 reasonable degree of certainty.

14:55:21        1        Q.     What would you estimate it as, how many  
14:55:23        2        degrees difference?  
14:55:26        3        A.     A couple degrees.  
14:55:27        4        Q.     Okay. So 43 to about 41 degrees Celsius;  
14:55:31        5        correct?  
14:55:31        6        A.     Correct.  
14:55:32        7        Q.     So the average temperature coming out of the  
14:55:33        8        Bair Hugger at about 41.1 seems reasonable.  
14:55:39        9        A.     It's not clear to me that this is the  
14:55:41        10      average temperature coming out of the Bair Hugger.  
14:55:44        11      What this says is "across the blanket." Now I would  
14:55:46        12      need to more -- know more information; for example,  
14:55:48        13      did they measure inside the channels of the -- of the  
14:55:51        14      Bair Hugger, or are they measuring outside or are they  
14:55:53        15      measuring the wall?  
14:55:54        16      Q.     I just told you. I told you.  
14:55:56        17      I said they have a thermal bed -- a  
14:55:57        18      thermocouple -- a table with many thermocouples, they  
14:55:59        19      placed the Bair Hugger on top, turn it on, of course  
14:56:02        20      the Bair Hugger's going to rise a little bit because  
14:56:04        21      of the -- because that's what it does, and the  
14:56:06        22      convective currents are hitting the thermocouples and  
14:56:08        23      this is the measurement. If that --  
14:56:10        24      Assuming that is the way they tested it,  
14:56:11        25      would you agree with me that the air coming out of the

14:56:13        1     blanket, on average, is 41.1 degrees Celsius?

14:56:17        2     MR. GOSS: Objection, lack of foundation.

14:56:19        3     This document does not contain any of those

14:56:21        4     experimental details.

14:56:23        5     Q. Assuming that's what -- that's what they

14:56:26        6     did, would you agree with me that the temperature

14:56:28        7     coming out is 41.1 degrees; "yes" or "no"? "Yes" or

14:56:31        8     "no"?

14:56:32        9     A. You take --

14:56:32        10    Q. If you don't agree, you don't agree.

14:56:34        11    A. It's not that I agree or disagree, but I

14:56:38        12    would, for example, want to know the room temperature,

14:56:40        13    and I would want to know the constitution of the table

14:56:43        14    upon which they sit this. If they put it on a table

14:56:45        15    that's an insulator you're going to get a higher

14:56:48        16    temperature. If it's in a room -- If it's covered by

14:56:51        17    draping and blankets you'll get a higher temperature.

14:56:53        18    There are many factors that go into these

14:56:55        19    temperatures, and from this document I cannot assess

14:56:57        20    them.

14:56:57        21    Q. Okay. But you agree that the 41 degrees

14:57:00        22    that you used is consistent with the 41 degrees that

14:57:03        23    is coming out of the blanket according to this

14:57:05        24    document, Exhibit Number 8; correct?

14:57:08        25    A. I am not in agreement that -- If --

14:57:12 1 If this MCST is the temperature coming out  
14:57:15 2 of the blanket, if it is, then yes, the value I used  
14:57:19 3 is consistent with it.

14:57:20 4 Q. Okay. Which would be inconsistent with what  
14:57:26 5 Dr. Settles measured less than one millimeter coming  
14:57:27 6 out of the hole; correct?

14:57:28 7 MR. GOSS: Object to form.

14:57:29 8 A. I don't believe they are inconsistent.

14:57:32 9 Q. Okay. Are you aware that Dr. Settles  
14:57:39 10 criticized your boundary conditions?

14:57:41 11 A. Yes.

14:57:41 12 Q. Okay. So you believe that you could get a  
14:57:46 13 measurement less than one millimeter out of a heated  
14:57:49 14 air jet that dropped the temperature from 41 degrees  
14:57:52 15 to 32 to 33 degrees?

14:57:57 16 A. That's not necessarily the case. In my  
14:58:00 17 experience with these blankets every blanket that I've  
14:58:03 18 seen has a temperature variation across the blanket.  
14:58:07 19 It would go from maybe 43 down to 37 or 35.

14:58:13 20 Q. You just testified a Delta of two degrees  
14:58:15 21 from one end to the other.

14:58:17 22 A. I don't know if I did, and if I did, that  
14:58:19 23 was not --

14:58:20 24 Q. So it's incorrect testimony back then?

14:58:22 25 A. Well I'd have to see the question. It may

14:58:24 1 be. You may be misrepresenting the question that you  
14:58:26 2 asked.

14:58:27 3 Q. Oh no. I said to you: The hose here, 43  
14:58:29 4 degrees, what would be the temperature drop at the  
14:58:31 5 other end of the Bair Hugger blanket, and you said  
14:58:33 6 about two degrees.

14:58:34 7 Do you remember me putting my arms like  
14:58:36 8 this?

14:58:36 9 A. Yeah. I would not agree with that.

14:58:38 10 Q. Okay.

14:58:38 11 A. What I would say is -- and I remember the  
14:58:40 12 context of this where you posed a hypothetical to me,  
14:58:44 13 or you -- you presented to me an experiment, and the  
14:58:47 14 experiment that you presented was, assume that the  
14:58:51 15 average air temperature coming out of the blanket's  
14:58:53 16 41; is that consistent with your work? And I agreed  
14:58:57 17 to that.

14:58:58 18 Q. Okay.

14:58:58 19 A. But that is not the same as saying it's a  
14:59:02 20 Delta T of two degrees across the blanket.

14:59:08 21 Q. And your mass flow rate coming out of the  
14:59:14 22 Bair Hugger device is .025 kilograms per second;  
14:59:18 23 correct? Page 5.

14:59:26 24 A. No. I used .023.

14:59:30 25 Q. Okay. For a partially obstructed blanket

14:59:33        1     because the blanket was tucked underneath the table;  
14:59:36        2     correct?  
14:59:36        3     A.     Correct.  
14:59:37        4     Q.     Okay. Where'd you obtain these numbers?  
14:59:40        5     A.     These are numbers that are consistent with  
14:59:43        6     my experience working on blankets like this measuring  
14:59:46        7     airflow, and they were confirmed by a tech document  
14:59:48        8     from 3M.  
14:59:49        9     Q.     Okay. Is it the tech document that has not  
14:59:55        10    been produced by you in this case, but it was produced  
14:59:58        11    in another production? If you know.  
15:00:04        12    A.     I produced the tech document.  
15:00:07        13    Q.     Okay.  
15:00:07        14    A.     I did not create it.  
15:00:10        15    Q.     Who created it?  
15:00:11        16    A.     I don't know the answer.  
15:00:13        17    Q.     Okay.  
15:00:59        18    MR. ASSAAD: Let's take a break.  
15:01:00        19    THE REPORTER: Off the record, please.  
15:01:03        20    (Recess taken from 3:01 to 3:11 p.m.)  
15:11:55        21    BY MR. ASSAAD:  
15:11:58        22    Q.     In your manuscript that you submitted for  
15:12:05        23    publication you put equations down; correct?  
15:12:07        24    A.     Correct.  
15:12:08        25    Q.     Why'd you put equations down in that report

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15:12:10 1 and not in the expert report of Exhibit 1?

15:12:15 2 A. It's a different audience, it would be read

15:12:17 3 by scientists who would want the equations.

15:12:20 4 Q. Do you not think that Dr. Elghobashi would

15:12:23 5 want to know the equations that you used for your

15:12:25 6 model?

15:12:26 7 A. Dr. Elghobashi, when he sees that I used the

15:12:29 8 LES model, would know what the equations are.

15:12:31 9 Q. Well wouldn't people that are reviewing

15:12:34 10 numerical heat transfer know what the equations are in

15:12:39 11 the use of the LES model?

15:12:40 12 A. They would.

15:12:41 13 Q. So why would you put the equations down if

15:12:43 14 they already know the equations, like Dr. Elghobashi?

15:12:47 15 A. Overthoroughness.

15:12:48 16 Q. Okay. So you were thorough in your

15:12:50 17 manuscript, but you were not thorough with respect to

15:12:53 18 identifying the equations you used in your expert

15:12:55 19 report.

15:12:56 20 MR. GOSS: Object to form.

15:12:58 21 A. I identified the equations in the expert

15:13:01 22 report by indicating the model that was used.

15:13:05 23 Q. Okay. Do you know what --

15:13:06 24 You said LES; correct?

15:13:07 25 A. Correct.

15:13:08 1 Q. Okay. And are you sitting here --  
15:13:11 2 Are you sitting here today and telling me  
15:13:14 3 that you know the equations that were used by ANSYS  
15:13:18 4 when you clicked -- when you used the LES model in  
15:13:22 5 ANSYS?  
15:13:23 6 A. There are thousands of equations. I know  
15:13:27 7 the key equations.  
15:13:28 8 Q. But you don't know the code; do you?  
15:13:31 9 A. I mean, I -- I know how to do compu --  
15:13:35 10 Q. You do not know the ANSYS code --  
15:13:38 11 MR. GOSS: Well, hold on.  
15:13:40 12 Q. -- sitting here today; correct?  
15:13:42 13 MR. GOSS: Let him finish -- Let him finish  
15:13:45 14 his answer, then you can ask another question.  
15:13:47 15 A. CFX is based on something called  
15:13:49 16 control-volume analysis for fluid mechanics. I've  
15:13:52 17 taken a number of courses at the graduate and  
15:13:55 18 undergraduate level on that topic. I could write the  
15:13:56 19 equations if I had to. Fortunately, they're contained  
15:13:58 20 within the software.  
15:13:59 21 Q. Okay. But for the manuscript you decided to  
15:14:02 22 put the equations, but you did not decide to put them  
15:14:05 23 in your expert report; correct?  
15:14:06 24 A. For the manuscript I put a brief summary of  
15:14:09 25 the equations, and I did not put them in the expert

15:14:11 1 report.

15:14:12 2 Q. Did you put the Navier-Stokes equations?

15:14:15 3 A. Yes.

15:14:17 4 Q. Did you put the Boussinesq equations?

15:14:18 5 A. No.

15:14:19 6 Q. Okay. So you would agree with me that --

15:14:39 7 I mean, you saw Dr. Elgho's report before

15:14:44 8 you submitted your final report in this case; correct?

15:14:46 9 A. That is correct.

15:14:47 10 Q. And you had the opportunity, if you so

15:14:50 11 choose, to add the equations; correct?

15:14:53 12 A. That is correct.

15:14:53 13 Q. And in fact the only thing you pretty much

15:14:55 14 had to do was copy and paste from your manuscript,

15:14:58 15 because your manuscript's already submitted by that

15:15:00 16 point in time; correct?

15:15:02 17 A. Yes.

15:15:02 18 Q. But you decided not to do that; correct?

15:15:04 19 A. Correct.

15:15:05 20 Q. Okay. And you assumed that the lawyers, or

15:15:10 21 our consultants, or even Judge Erickson is a different

15:15:14 22 audience than the peer reviewers for the -- for the

15:15:17 23 journal; correct?

15:15:19 24 A. Yes.

15:15:20 25 Q. Okay. You do understand that Judge Erickson

15:15:22 1 is the judge in this case.

15:15:25 2 A. No. You're telling me that now.

15:15:27 3 Q. Well the -- the female judge that you were

15:15:29 4 in front of on Science Day was Judge Ericksen.

15:15:31 5 A. Okay.

15:15:32 6 Q. You understand that; correct?

15:15:34 7 And she is the judge of this MDL. You

15:15:36 8 understand that.

15:15:38 9 A. Yes.

15:15:40 10 Q. And she decides whether or not expert

15:15:42 11 opinions will eventually come in or not come in during

15:15:44 12 trial. Do you understand that?

15:15:46 13 A. That is my understanding.

15:15:48 14 Q. Okay. Have you ever had your expert

15:15:50 15 opinions limited in any way?

15:15:52 16 A. Yes.

15:15:54 17 Q. When?

15:15:56 18 A. Very recently in an intellectual property

15:15:58 19 case.

15:15:60 20 Q. In what court?

15:16:02 21 A. I don't know.

15:16:04 22 Q. What state?

15:16:06 23 A. May I go to my --

15:16:08 24 Q. Sure.

15:16:10 25 A. -- CV? (Witness reviewing exhibit.)

15:16:31 1 Select Comfort versus Tempur Sealy, Eighth  
15:16:35 2 District Court, Minnesota.  
15:16:36 3 Q. Okay. Is it --  
15:16:40 4 Was it state court?  
15:16:42 5 A. Well it's U.S. Eighth District Court.  
15:16:46 6 Q. What page were you looking at?  
15:16:47 7 A. Page 4.  
15:16:52 8 Q. Of your CV, of Exhibit 2?  
15:16:56 9 A. Yes.  
15:17:06 10 Q. And was your entire expert opinion excluded?  
15:17:09 11 A. No.  
15:17:09 12 Q. What part of it was?  
15:17:11 13 A. A very small fraction.  
15:17:12 14 Q. Okay.  
15:17:12 15 A. One opinion.  
15:17:13 16 Q. Was there an opinion issued by the court as  
15:17:16 17 to why it was excluded?  
15:17:17 18 A. Yes.  
15:17:17 19 Q. Okay. What was the reasoning; do you  
15:17:19 20 recall?  
15:17:19 21 A. No.  
15:17:20 22 Q. Okay. And this was back in 2014?  
15:17:24 23 A. The decision came out perhaps a month ago.  
15:17:27 24 Q. Okay. And you said United States Eighth  
15:17:31 25 District Court?

15:17:38 1 A. I'm an engineer, so perhaps I got the court  
15:17:40 2 wrong.  
15:17:41 3 Q. Okay.  
15:17:41 4 A. But that's the best of my --  
15:17:44 5 Q. Was the case originally in Minnesota, like  
15:17:49 6 -- or was it in a different state?  
15:17:51 7 MR. GOSS: I think he gave you a file  
15:17:52 8 number.  
15:17:55 9 MR. ASSAAD: Page 4?  
15:17:57 10 MR. GOSS: I think it's -- the file number  
15:17:58 11 is listed right below where it says "United States  
15:18:03 12 8th District Court, Minnesota."  
15:18:10 13 MR. ASSAAD: Okay.  
15:18:16 14 Q. Was that also in front of Judge Erickson?  
15:18:19 15 A. Well the -- I don't know who it's in front  
15:18:22 16 of.  
15:18:32 17 MR. GOSS: That's Janie S. Mayeron.  
15:18:37 18 MR. ASSAAD: Huh?  
15:18:37 19 MS. ZIMMERMAN: That's a Magistrate. Janie  
15:18:39 20 S. Mayeron.  
15:18:39 21 MR. GOSS: "JSM" is Janie S. Mayeron.  
15:18:41 22 MR. ASSAAD: Okay.  
15:18:43 23 BY MR. ASSAAD:  
15:18:43 24 Q. So Judge Erickson limited your expert  
15:18:46 25 opinion?

15:18:47 1 MR. GOSS: Objection, lack of foundation.

15:18:50 2 A. What I know is -- I don't know which judge

15:18:53 3 or which court limited it. The extent of my knowledge

15:18:58 4 is indicated by this court file number. I don't know

15:19:00 5 who it was.

15:19:01 6 Q. Okay. Now 3M's a pretty big company;

15:19:07 7 correct?

15:19:09 8 A. I believe that's true.

15:19:10 9 Q. Worth more than a billion dollars?

15:19:13 10 A. I believe that's true.

15:19:15 11 Q. So if they wanted to they could have spent

15:19:21 12 more money and created a very detailed model, CFD

15:19:27 13 model if they wanted to, and paid you for it; correct?

15:19:30 14 MR. GOSS: Object to form.

15:19:31 15 A. Yes.

15:19:38 16 Q. Okay. I mean, for example, there was

15:19:40 17 nothing preventing you from adding surgeons and staff

15:19:45 18 in your model; correct?

15:19:47 19 A. Correct.

15:19:48 20 Q. Except time and money; correct?

15:19:51 21 A. Incorrect.

15:19:53 22 Q. Okay. So you could have added people;

15:19:55 23 correct?

15:19:56 24 A. Correct.

15:19:57 25 Q. You could have given properties to the

15:19:59 1 materials; correct?

15:20:01 2 A. That is correct.

15:20:02 3 Q. Okay. You could have had a --

15:20:04 4 You could have done particle testing, or

15:20:08 5 added particles; correct?

15:20:09 6 A. Correct.

15:20:10 7 Q. You could have put skin squames like Dr.

15:20:12 8 Elghobashi and Farhad Memarzadeh did in their studies?

15:20:18 9 A. They did not put skin squames in, --

15:20:22 10 Q. They --

15:20:20 11 A. -- but I could have done particle tracking.

15:20:24 12 Q. You're right, they did not put skin squames.

15:20:28 13 They calculated the aerodynamic diameter of the skin

15:20:33 14 squames and placed those in their studies; correct?

15:20:33 15 A. Incorrect.

15:20:33 16 Q. They didn't calculate the aerodynamic

15:20:34 17 diameter?

15:20:34 18 A. They related skin squa -- skin squames to

15:20:38 19 spheres whose diameter gave the same settling

15:20:43 20 velocity. That's not the same as aerodynamics.

15:20:46 21 Q. Okay. But they both did the same thing.

15:20:48 22 A. I know that's what Said Elghobashi did. I

15:20:52 23 don't recall, sitting here, what Memarzadeh did.

15:20:54 24 Q. Did you read Farhad Memarzadeh's report on

15:20:58 25 the use of a Bair Hugger in a operating room?

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15:21:02 1 A. I read multiple papers of his, so I'm  
15:21:06 2 certain I read...  
15:21:08 3 He's done more than one.  
15:21:10 4 Q. Okay. Did you read the one that dealt with  
15:21:13 5 the Bair Hugger 505 and its effect on the laminar  
15:21:16 6 system and where skin squames that were represented as  
15:21:20 7 spheres would go?  
15:21:22 8 A. I believe I did read that.  
15:21:23 9 Q. Okay. And do you recall reading that he  
15:21:27 10 indicated that the Bair Hugger 505 slightly disrupted  
15:21:34 11 the laminar flow?  
15:21:36 12 A. I do not recall reading that.  
15:21:38 13 Q. Would you agree with that if he said that?  
15:21:42 14 A. It depends on what you mean by "disrupt." I  
15:21:45 15 know that Memarzadeh's work has shown that for -- that  
15:21:50 16 warming devices create a thermal plume, and in fact I  
15:21:56 17 think the body heat of the patient create a thermal  
15:21:59 18 plume that protects the surgical site, so I recall  
15:22:02 19 that.  
15:22:04 20 Anyone who's done an analysis has to admit  
15:22:07 21 that everything in the room affects the flow. So no  
15:22:11 22 one can say it has no effect.  
15:22:12 23 Q. So everything in the room affects the flow.  
15:22:15 24 Is that what you're saying?  
15:22:17 25 A. Yes.

15:22:17 1 Q. So people affect the flow; correct?

15:22:18 2 A. That is correct.

15:22:19 3 Q. Okay. Actually a -- a Bair Hugger device

15:22:26 4 that's sitting on the floor that sucks up air is going

15:22:29 5 to affect the flow; correct?

15:22:31 6 A. That is correct.

15:22:31 7 Q. Okay. And in fact you did not even put the

15:22:33 8 Bair Hugger device in your model; correct?

15:22:35 9 A. That is correct.

15:22:36 10 Q. Okay. The fact that heat might be causing

15:22:41 11 thermal plumes through, you know, the Bair Hugger

15:22:44 12 heating the blankets through conduction which create a

15:22:47 13 thermal plume is going to affect the flow; correct?

15:22:51 14 A. Correct.

15:22:51 15 Q. Okay. But none of those things you decide

15:22:54 16 to put into your model because you thought they would

15:22:57 17 be insignificant; correct? With what you're trying to

15:23:00 18 determine.

15:23:02 19 A. Correct.

15:23:03 20 Q. And that was your judgment call; correct?

15:23:05 21 A. Yes.

15:23:06 22 Q. And other people in the scientific community

15:23:08 23 may disagree with you on that; correct?

15:23:10 24 A. Yes.

15:23:43 25 Q. Sitting here today I cannot determine, or

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15:23:46 1 anyone on my team, or my consultants, whether or not  
15:23:49 2 the equations that you used are the appropriate  
15:23:53 3 equations for the model because you did not inform me  
15:23:57 4 what the equations are; correct?

15:23:58 5 MR. GOSS: Well objection, lack of  
15:24:01 6 foundation as to what you would know or be able to  
15:24:02 7 do.

15:24:05 8 A. You know that I used the LES method. The  
15:24:09 9 equations -- If you need to see the equations written  
15:24:12 10 down they would be contained within the ANSYS theory  
15:24:15 11 manual. So yes, sitting here today you could.

15:24:20 12 Q. Okay. You agree with that ANSYS is not  
15:24:24 13 verified for every single type of physics; correct?

15:24:30 14 A. I don't understand your question.

15:24:32 15 Q. Well "verified" applies to the mathematics  
15:24:35 16 and "validation" applies to the physics. Do you  
15:24:38 17 understand that?

15:24:39 18 Have you ever heard that before?

15:24:40 19 A. I've heard it in a different -- slightly  
15:24:42 20 different phrasing, but essentially yes.

15:24:47 21 Q. Okay. Let me ask you this. Well, strike  
15:24:59 22 that.

15:25:00 23 Did you -- I might have asked this. Did you  
15:25:01 24 put the initial conditions in your manuscript?

15:25:04 25 A. No.

15:25:04 1 Q. Okay. For either the 505 or the 750?

15:25:10 2 A. Correct.

15:25:12 3 Q. Is that common practice with respect to  
15:25:15 4 people in the CFD community when submitting a  
15:25:19 5 peer-review paper on a model not to put the input  
15:25:25 6 conditions?

15:25:27 7 A. When you say "manuscript," are you talking  
15:25:29 8 about the manuscript that's my expert report?

15:25:34 9 Q. No. Your expert report's your expert  
15:25:36 10 report. Your manuscript is what's been submitted for  
15:25:38 11 publication.

15:25:39 12 A. Thank you for clarifying.

15:25:41 13 In the manuscript for publication I show --  
15:25:44 14 I show quasi-steady results have been achieved by  
15:25:47 15 comparing two results at different times, and that is  
15:25:51 16 sufficient, in my mind, for a peer-reviewed  
15:25:57 17 publication.

15:26:05 18 Q. Okay. Would you consider the Reynolds  
15:26:19 19 number --

15:26:19 20 Let me ask you this. Is the Reynolds number  
15:26:22 21 related to computational time in LES?

15:26:42 22 A. Yes.

15:26:43 23 Q. Okay. So the higher the Reynolds number is,  
15:26:46 24 the longer the computational time may be; correct?  
15:26:52 25 It's Reynolds cubed is the -- the -- CFD that you guys

15:26:59 1 use to determine the relative compu --

15:27:01 2 (Interruption by the reporter.)

15:27:02 3 Q. -- Reynolds cubed to determine the relative

15:27:03 4 computational time it takes -- or how much

15:27:05 5 computational time is needed to solve an LES problem.

15:27:08 6 Do you agree?

15:27:09 7 A. I don't know that.

15:27:10 8 Q. Okay. Do you agree that the most difficult

15:27:22 9 calculations in computational fluid dynamics is the

15:27:31 10 area where there's a transition between laminar and

15:27:35 11 turbulent?

15:27:40 12 A. I would agree that that is a very difficult

15:27:42 13 calculation in computational fluid dynamics.

15:27:44 14 Q. Do you know whether or not ANSYS is able to

15:27:46 15 calculate those transition -- those -- those

15:27:48 16 transition areas?

15:27:49 17 A. Yes.

15:27:50 18 Q. It can?

15:27:50 19 A. Yes.

15:27:51 20 Q. Okay. The Boussinesq approximation, what is

15:27:58 21 its -- what is its underlying assumption?

15:28:02 22 A. The underlying assumption behind the

15:28:05 23 Boussinesq approximation is that you relate density

15:28:09 24 changes, which are the cause of buoyancy, to

15:28:12 25 temperature changes.

15:28:16 1 Q. So you would agree with me that in the  
15:28:19 2 Boussinesq approximation it disregards density for  
15:28:22 3 every variable except for gravity; correct?  
15:28:25 4 A. Incorrect.  
15:28:28 5 Q. So what's your definition again?  
15:28:30 6 A. The Boussinesq model represents density  
15:28:34 7 variations through variations in temperature.  
15:28:52 8 Q. You sure about that?  
15:28:54 9 A. Yes.  
15:30:06 10 Q. So what variables does density affect in the  
15:30:12 11 Boussinesq model?  
15:30:15 12 A. Your question is not well posed.  
15:30:18 13 Let me say this. When people use the  
15:30:21 14 Boussinesq model they're relating density variation in  
15:30:24 15 a fluid in the buoyancy term, to temperature  
15:30:30 16 variation.  
15:30:38 17 Q. Do you agree that the Boussinesq  
15:30:46 18 approximation, which came out in 1903, suggested that  
15:30:49 19 density changes in the fluid can be neglected except  
15:30:52 20 where mu is multiplied by G, which is gravity, or  
15:30:57 21 density is multiplied by G, which is gravity.  
15:30:59 22 A. Can you say that again?  
15:31:01 23 Q. Do you agree that Boussinesq came out in  
15:31:05 24 1903. Are you -- Are you familiar with that?  
15:31:07 25 A. I don't know the year it came out.

15:31:09 1 Q. Okay. Suggested that density changes in the  
15:31:11 2 fluid can be neglected except where density is re --  
15:31:15 3 is multiplied by gravity. So it only applies to the  
15:31:19 4 gravity term.

15:31:21 5 A. That's what I said in my answer.

15:31:23 6 Q. Okay. So you agree with me that density is  
15:31:25 7 a constant except for with relation to gravity.

15:31:31 8 A. In the model that I used density was treated  
15:31:33 9 as a constant with the exception of the term for  
15:31:37 10 buoyancy, the density variations in buoyancy.

15:31:41 11 Q. Okay.

15:31:41 12 A. I would agree with that.

15:31:46 13 Q. And you agree with me that the most common  
15:31:49 14 areas that Boussinesq has been used is in natural  
15:31:53 15 convection equations.

15:31:55 16 A. I don't know if that's a fact, but that  
15:31:58 17 would not surprise me. I believe that's true.

15:32:00 18 Q. And when you have a high Delta T temperature  
15:32:05 19 difference, that the Boussinesq approximation may  
15:32:07 20 fail.

15:32:08 21 A. That is correct.

15:32:09 22 Q. What would you consider a high temperature  
15:32:11 23 difference?

15:32:12 24 A. That's a very good question.  
15:32:14 25 In 2003 I did a study on the applicability

15:32:18        1    of the Boussinesq model and we compared it to the  
15:32:21        2    ideal gas model, and we used a situation where the  
15:32:24        3    temperature difference was 150 degrees Celsius. We  
15:32:28        4    found that in that case the Boussinesq model did an  
15:32:31        5    excellent job of calculating the flow in an enclosure  
15:32:35        6    in a room.

15:32:36        7    Q.    Airflow or particle flow?

15:32:38        8    A.    Airflow.

15:32:38        9    Q.    What about with respect to particle flow?

15:32:42        10    A.    In my simulations I used airflow as a  
15:32:46        11    surrogate for particles because it's a worst-case  
15:32:49        12    scenario. I did not -- As I stated already, I did not  
15:32:53        13    model particles.

15:32:54        14    Q.    So you assumed that airflow was the  
15:32:56        15    worst-case scenario as compared to particle flow?

15:32:59        16    A.    Yes.

15:33:00        17    Q.    And your basis behind that assumption?

15:33:03        18    A.    Simple. Particles have a mass that is  
15:33:08        19    higher than their surrounding air, so particles like  
15:33:11        20    to settle out of the air. And in fact Said Elghobashi  
15:33:15        21    found his equivalent diameter by using the settling  
15:33:19        22    diameter. Particles like to fall out of the flow.  
15:33:22        23    Furthermore, particles have inertia. Multiple experts  
15:33:25        24    have already testified to this fact. Particles have  
15:33:28        25    inertia, and they find it hard to follow curved

15:33:32 1 streamlines, and that tends to bring particles out of  
15:33:35 2 the flow.

15:33:35 3 So for those two reasons I decided to use  
15:33:39 4 the worst-case scenario, which is air. I tracked air  
15:33:42 5 particles which have no gravity term and no inertia  
15:33:46 6 term. So in that respect it's a worst-case  
15:33:49 7 calculation.

15:33:52 8 Q. Well, I disagree with you mathematically and  
15:33:55 9 as a worst-case scenario, and I'm going to tell you  
15:33:58 10 why.

15:33:58 11 You don't think turbulence causes the spread  
15:34:00 12 of particles?

15:34:03 13 A. I think turbulence does cause the spread of  
15:34:04 14 particles.

15:34:05 15 Q. And don't you think that temperature  
15:34:06 16 differences affect the turbulence intensity?

15:34:10 17 A. And in fact I included that in my analysis.

15:34:13 18 Q. So you agree with me they do; correct?

15:34:15 19 A. I agree that temperature affects turbulence.

15:34:18 20 Q. Okay. And the fact that particles don't

15:34:20 21 follow streamlines is that they may -- they may act  
15:34:25 22 with -- they may follow velocity vectors caused by  
15:34:30 23 turbulence; correct?

15:34:41 24 A. I'm not struggling because I can't answer  
15:34:43 25 it, I'm struggling to interpret your question and to

15:34:45 1 figure out a way to artfully answer.

15:34:48 2 Turbulence affects particles, and in fact

15:34:54 3 particles can affect turbulence. Particles have

15:34:58 4 inertia, and when a particle gets caught in an eddy it

15:35:02 5 likes -- it has a tendency to leave that eddy.

15:35:06 6 So if you look at the simulations that I

15:35:07 7 have where the flow goes down, curves against the

15:35:11 8 ground and then curves against the wall, particles

15:35:14 9 would have a tendency to leave the flow at that

15:35:16 10 instant and land on the ground and the wall and

15:35:19 11 surfaces, and in fact that's why we dust. We dust, if

15:35:24 12 we're cleaning our house, because particles collect on

15:35:27 13 a table. But there's not air particles collecting on

15:35:30 14 this table, there's particles in -- in the air.

15:35:34 15 By giving -- I essentially gave my particles

15:35:36 16 a zero mass so they had no weight, and zero inertia so

15:35:43 17 that they would perfectly follow the flow. And

15:35:46 18 whether that flow was turbulent or not they follow the

15:35:49 19 flow. That's why it's a worst-case scenario.

15:35:51 20 Q. Well I think you just misspoke, sir, because

15:35:53 21 you didn't use particles in your analysis; correct?

15:35:55 22 A. I did not misspeak.

15:35:57 23 Q. Well you did, because you said I gave my

15:35:59 24 particles no inertia and no mass, but you did not use

15:36:02 25 particles in your CFD; isn't that correct?

15:36:05        1        A.        Actually the particles I used were air  
15:36:07        2        particles. I tracked air. So we can talk about  
15:36:10        3        particles, essentially I used oxygen and nitrogen  
15:36:14        4        molecules. I followed the air, not a solid,  
15:36:19        5        inertia-filled particle through the air.  
15:36:21        6        Q.        So you do not insert particles that have a  
15:36:23        7        mass into your system; correct?  
15:36:25        8        A.        That is correct.  
15:36:26        9        Q.        Okay. And you agree that the reason why  
15:36:32        10      there are particle models is because people in the  
15:36:36        11      scientific community understand that particles do --  
15:36:41        12      always don't react or follow airstreams; correct?  
15:36:44        13      A.        That's correct.  
15:36:45        14      Q.        Okay.  
15:36:46        15      A.        In fact I've done particle modeling in the  
15:36:48        16      peer review --  
15:36:51        17      Q.        I know what you've done. I'm -- Just answer  
15:36:51        18      my questions, please.  
15:36:52        19      A.        Okay.  
15:36:52        20      Q.        So the fact that --  
15:36:53        21      I mean, turbulence has a significant effect  
15:36:57        22      on particle flow; don't you agree?  
15:36:59        23      MR. GOSS: That's asked and answered, but  
15:37:00        24      if you have more to say, please go ahead.  
15:37:04        25      A.        They may, and they may not.

15:37:08 1 Q. But you don't know until you model it;  
15:37:10 2 correct?

15:37:12 3 A. That is not true.

15:37:14 4 Q. Okay. Are there any turbulent areas in the  
15:37:19 5 operating room that would be significant with respect  
15:37:21 6 to whether or not particles could actually cause harm  
15:37:29 7 to a patient?

15:37:33 8 A. Could you restate that question?

15:37:34 9 Q. That's a bad question.

15:37:35 10 Are there -- Are there any areas that there  
15:37:38 11 exist significant turbulence in the operating room  
15:37:43 12 model that would have an effect on particles that  
15:37:47 13 would indicate to you that the particles would not  
15:37:49 14 follow streamlines?

15:37:56 15 A. That's still a confusing question, but I'm  
15:37:58 16 going to give an answer. I modeled turbulence. I  
15:38:05 17 modeled particles that had the characteristics of air.  
15:38:11 18 Insofar as there's turbulent motion in the air, those  
15:38:16 19 carry the air. So whether we're talking about a  
15:38:20 20 particle or not, turbulence -- whether we're talking  
15:38:23 21 about a solid particle or whether we're talking about  
15:38:25 22 air, the motion is affected by the turbulence and I  
15:38:29 23 included that in my model.

15:38:36 24 Q. What was the turbulent intensity --

15:38:39 25 If I ask you what the turbulent intensity

15:38:41 1 was underneath the operating room table could you tell  
15:38:44 2 me what that is in your model?

15:38:45 3 A. I could, and I don't have that information

15:38:47 4 here with me.

15:38:47 5 Q. Okay. How would you do it? What would you

15:38:50 6 look at?

15:38:51 7 A. I would either calc -- I would either have

15:38:57 8 the software extract the turbulence intensity, or I

15:39:00 9 would look at a surrogate like the eddy viscosity.

15:39:04 10 Q. Can ANSYS CFX determine turbulence

15:39:08 11 intensity? Is there actually a function to do that?

15:39:11 12 A. I believe there is, and if not you can do it

15:39:13 13 through other -- other parameters that it calculates.

15:39:16 14 Q. The eddy viscosity.

15:39:18 15 A. Yes.

15:39:19 16 Q. Okay.

15:39:20 17 A. In fact all you need is the fluctuating

15:39:24 18 component of the velocities and the average

15:39:27 19 velocities.

15:39:27 20 Q. Okay. In your manuscript did you indicate,

15:39:45 21 with respect to the 750, why -- or what data that you

15:39:49 22 used to show that it was a quasi-steady solution?

15:39:54 23 A. In my manuscript I compared two sets of

15:39:56 24 results that differed substantially in time step and

15:40:00 25 showed that they were immaterially different.

15:40:03 1 Q. For the 750 or the 505?

15:40:05 2 A. 750.

15:40:06 3 Q. Okay. And that would be the 264 and the 300

15:40:10 4 something?

15:40:12 5 A. No. I think they were further apart than

15:40:14 6 that.

15:40:25 7 Q. All right. Did you provide those data files

15:40:30 8 to counsel?

15:40:34 9 A. I don't know if I did. The data files for

15:40:37 10 the journal paper? I don't recall.

15:41:02 11 Q. And you didn't cite your reasoning or your

15:41:07 12 data to support that you reviewed the results to get a

15:41:14 13 quasi-steady solution with respect to the expert

15:41:18 14 report; correct?

15:41:22 15 A. Could you ask that again?

15:41:23 16 Q. In your expert report you did not provide

15:41:24 17 that information of the data points that you looked at

15:41:28 18 for you -- for your determination that the solution

15:41:32 19 that you provided was a quasi-steady solution.

15:41:40 20 A. No, that's not quite true. On page 9 I

15:41:44 21 actually say that images from Figures 3 through 8

15:41:47 22 could be replicated at other instances -- time instances

15:41:51 23 and the same conclusions would be drawn.

15:41:53 24 Q. I understand that.

15:41:54 25 But it's a judgment call by you whether or

15:41:56 1 not you had a quasi-steady solution; correct?

15:41:58 2 A. Correct.

15:41:59 3 Q. And I might look at it, or my expert might

15:42:02 4 look at it and disagree with you; correct?

15:42:04 5 A. That's -- That's possible.

15:42:05 6 Q. Okay. And they can't do that because you

15:42:08 7 did not provide that data in your expert report;

15:42:09 8 correct?

15:42:11 9 MR. GOSS: Object to form, --

15:42:11 10 A. They --

15:42:11 11 MR. GOSS: -- calls for speculation.

15:42:19 12 Q. The only way I could determine whether or

15:42:21 13 not you have a quasi-steady solution is to look at two

15:42:25 14 -- at least two TRN files; correct?

15:42:27 15 A. Correct.

15:42:28 16 Q. I only have one TRN file. You understand

15:42:30 17 that; correct?

15:42:31 18 A. Yes.

15:42:31 19 Q. And you did not -- you only plotted

15:42:34 20 solutions for one TRN file in your -- in your expert

15:42:37 21 report; correct?

15:42:37 22 A. That is correct.

15:42:38 23 Q. Okay. So sitting here today I don't have --

15:42:42 24 no one in the world has any information to make their

15:42:47 25 own judgment call whether or not the two solutions are

15:42:51        1 close enough to make the judgment -- judgment that  
15:42:54        2 it's a quasi-steady solution; correct?  
15:42:58        3            A. From the data --  
15:42:59        4            From the single TRN file that I provided,  
15:43:01        5 correct.  
15:43:02        6            Q. Okay. And nothing in the report.  
15:43:04        7            A. Well I stated it in the report.  
15:43:06        8            Q. That's your opinion.  
15:43:07        9            But I'm saying for someone to ascertain and  
15:43:10        10 make a determination of whether or not your judgment  
15:43:13        11 is correct, no one could do that right now based on  
15:43:16        12 the expert report; correct?  
15:43:18        13            MR. GOSS: Argumentative, asked and  
15:43:19        14 answered.  
15:43:19        15            A. Correct.  
15:43:20        16            Q. Okay. Just out of curiosity, when you ran  
15:44:26        17 the model with 8.1 million cells that you said took  
15:44:30        18 roughly 40 days, was that the only program that was  
15:44:36        19 running on that machine?  
15:44:38        20            A. I don't know.  
15:44:39        21            Q. Okay. Does anyone else have access to that  
15:44:43        22 machine that you used?  
15:44:44        23            A. Yes.  
15:44:45        24            Q. Okay. Is it a single desktop computer or  
15:44:50        25 does it use, like, a combination of computers to

15:44:53 1 solve?

15:44:54 2 A. Single desktop.

15:44:57 3 Q. Why didn't you use the Minnesota

15:44:58 4 supercomputer?

15:45:01 5 A. I have enough computer power with me, and

15:45:05 6 there was no reason to use the Minnesota

15:45:09 7 supercomputer.

15:45:09 8 Q. Well you could have --

15:45:09 9 I mean that supercomputer has I think 16,000

15:45:12 10 cores. Does that sound about right?

15:45:15 11 A. I don't know how many cores it has, but

15:45:18 12 there is an inconvenience of queuing your jobs, and

15:45:22 13 I'm not -- and I wasn't willing to be subject to that

15:45:26 14 inconvenience.

15:45:27 15 Q. So you'd rather wait 40 days?

15:45:29 16 A. Yeah.

15:45:53 17 Q. Do you know who Lagrange is?

15:45:55 18 A. Yes.

15:45:56 19 Q. Do you know who Euler is?

15:45:56 20 A. Yes.

15:45:57 21 Q. Their equations were not used in your CFD

15:46:00 22 analysis; correct?

15:46:01 23 A. Incorrect.

15:46:02 24 Q. In what way were they used?

15:46:05 25 A. Well the Euler method, E-U-L-E-R, is

15:46:09 1 generally re -- Let me back up.

15:46:11 2 In an overview, Lagrange means you follow

15:46:18 3 the fluid or particle. The Euler method means that

15:46:23 4 you calculate the flow by sitting in a single place in

15:46:26 5 time and watching things go by you. So one has a

15:46:30 6 moving perspective reference frame and the other one

15:46:33 7 doesn't.

15:46:35 8 The CFD used to calculate the airflow is

15:46:38 9 Eulerian, E-U-L-E-R-I-A-N. Now it turns out that

15:46:44 10 these two ideas can be applied to particle tracking;

15:46:48 11 Lagrange particle tracking and Euler particle

15:46:53 12 tracking. And with respect to particle tracking I did

15:46:56 13 not -- not use either of them.

15:47:00 14 Q. Do you agree that current -- that ANSYS CFX

15:47:04 15 has limited capabilities for Lagrangian simulation?

15:47:11 16 A. I don't know that to be true.

15:47:13 17 Q. So you don't know one way or the other;

15:47:15 18 correct?

15:47:16 19 A. Well, I mean, every software has limited

15:47:19 20 capabilities, so I don't know the context of what

15:47:22 21 you're --

15:47:23 22 Q. And you don't know the code that's used

15:47:26 23 behind the black box of ANSYS; correct?

15:47:28 24 A. That's incorrect.

15:47:29 25 Q. Do you know the code?

15:47:29 1 A. I could actually write the code.

15:47:31 2 Q. Okay. But do you know the code?

15:47:36 3 A. What do you mean by "know the code"?

15:47:38 4 Q. Do you know the software or the code behind

15:47:40 5 ANSYS?

15:47:42 6 A. I would say this.

15:47:42 7 MR. GOSS: Asked and answered. Go ahead.

15:47:44 8 A. I would say this. I know the equations that

15:47:46 9 go in. I know the equations that ANSYS relies upon.

15:47:52 10 Q. I understand that. But everyone knows the

15:47:54 11 equations. Everyone knows Navier-Stokes; correct?

15:47:58 12 MR. GOSS: I don't.

15:48:00 13 A. Incorrect.

15:48:00 14 Q. Well people that are doing CFD, like

15:48:03 15 professors such as yourself should know the

15:48:05 16 Navier-Stokes equations; correct?

15:48:08 17 A. That is correct.

15:48:08 18 Q. Okay. And the people that are writing the

15:48:10 19 programs should know the Navier-Stokes equation;

15:48:13 20 correct?

15:48:14 21 A. Correct.

15:48:15 22 Q. But some codes are verified because the

15:48:19 23 mathematics work out, and other codes that use -- that

15:48:22 24 try to solve for the Navier-Stokes equation are not

15:48:25 25 verified. Do you agree with that?

15:48:31 1 A. I disagree.

15:48:33 2 Q. Okay.

15:48:33 3 A. I would have to understand more about the

15:48:35 4 hypothetical that you're --

15:48:37 5 Q. Well --

15:48:37 6 A. -- suggesting.

15:48:40 7 Q. -- I could write a code that solves for the

15:48:42 8 Navier-Stokes equations and I get wrong mathematical

15:48:47 9 results and therefore my code is not verified even

15:48:49 10 though I could write down the Navier-Stokes equations;

15:48:51 11 correct?

15:48:52 12 A. I agree.

15:48:53 13 Q. Okay. So a code needs to be verified;

15:48:55 14 correct?

15:48:56 15 A. I agree.

15:48:57 16 Q. Okay. So the code is more than just the

15:49:03 17 equation, it's actually the code is what they use --

15:49:06 18 do to solve the equation; correct?

15:49:10 19 A. In this context "code" usually refers to the

15:49:15 20 numerical algorithm that's used to solve the

15:49:18 21 Navier-Stokes equations.

15:49:19 22 Q. So the mere fact that I know the equation

15:49:21 23 doesn't mean I have the correct algorithm to solve the

15:49:24 24 equation accurately; correct?

15:49:26 25 A. I agree --

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15:49:26 1 Q. Okay.

15:49:27 2 A. -- with that statement.

15:49:28 3 Q. So the mere fact that you know the equations

15:49:31 4 that ANSYS used, you don't know the code or the

15:49:34 5 algorithm they used to solve the equation.

15:49:37 6 A. Incorrect.

15:49:38 7 Q. You do?

15:49:39 8 A. Well you have to be careful here because

15:49:42 9 there's many equations and many algorithms. It's not

15:49:45 10 as though there's a single algorithm for ANSYS.

15:49:47 11 For example, there is an algorithm on how to

15:49:49 12 solve the mass equation over each element. There's an

15:49:53 13 algorithm on how to solve the momentum equation.

15:49:56 14 There's an algorithm on how to evaluate the density

15:50:00 15 variation in a -- in a natural convection flow.

15:50:02 16 So there are many, many algorithms. It's

15:50:04 17 not as though there's a single algorithm for a code.

15:50:14 18 Q. Have you actually looked behind the software

15:50:19 19 and -- and the actual code that the programmers use

15:50:23 20 for ANSYS CFX?

15:50:25 21 A. In fact --

15:50:25 22 Q. It's a simple yes-or-no answer.

15:50:28 23 Have you looked at it? That's all I need to

15:50:30 24 know.

15:50:31 25 MR. GOSS: You can go ahead and answer.

15:50:32 1 A. In fact I've modified the code that they  
15:50:34 2 use.

15:50:34 3 Q. So you looked at it.

15:50:35 4 A. I have looked at the code.

15:50:37 5 Q. Okay. That's all I need to know.

15:50:45 6 How would you define "natural convection"?

15:50:48 7 A. Natural convection is the process --

15:50:51 8 Well colloquially hot air rises or heat

15:50:57 9 rises, but more exactly it's the process of fluid,

15:51:00 10 when it warms up -- and when I say "fluid" I mean a

15:51:03 11 gas or a liquid -- when it warms up it wants to

15:51:06 12 expand, and when it expands it's less dense so it

15:51:09 13 wants to rise. Think of a hot air balloon would be

15:51:12 14 natural convection.

15:51:12 15 Q. Do you agree with me that the density

15:51:15 16 between 41 degrees Celsius and the density of 59

15:51:21 17 degrees Celsius of air is different?

15:51:22 18 A. I would agree.

15:51:23 19 Q. Okay. And you agree with me that the

15:51:32 20 Boussinesq approximation does not take that difference

15:51:34 21 in density except for the gravity term; correct?

15:51:40 22 A. Incorrect. The Bou -- The dens -- The

15:51:43 23 buoyancy term is also in the turbulence production,

15:51:46 24 but it does not -- the density variation does not

15:51:50 25 appear in the other terms of the Navier-Stokes

15:51:53        1    equations. I think that's what you're trying to get  
15:51:55        2    at.

15:51:55        3    Q.    So you think it's part of the turbulence  
15:51:58        4    equations?

15:51:59        5    A.    The Boussinesq model, my recollection is  
15:52:04        6    that it includes density variations -- I'd have to go  
15:52:08        7    back and look.

15:52:09        8    The Boussinesq model relates density  
15:52:12        9    variations in the buoyancy term to temperature  
15:52:15        10   variations, period.

15:52:20        11   Q.    Do you recall what your -- Does ANSYS CFX --  
15:52:29        12   Strike that.

15:52:29        13   Does ANSYS CFX require you to give a  
15:52:38        14   temperature for -- a reference temperature for  
15:52:41        15   Boussinesq?

15:52:42        16   A.    Yes.

15:52:42        17   Q.    So what did you use?

15:52:44        18   A.    25 Celsius.

15:52:46        19   Q.    "25 Celsius"?

15:52:47        20   Why'd you use 25 Celsius?

15:52:49        21   A.    It's a good midpoint between 15 and 43.

15:52:54        22   Q.    So 25 Celsius, what's that in Fahrenheit?

15:53:10        23   MR. GOSS: I'm going to guess 74 degrees.

24                [Calculating.]

15:53:18        25   Q.    77 degrees.

15:53:20 1 So that's what you used is 77?

15:53:22 2 A. That's what I recall.

15:53:25 3 Q. Okay. You know, why'd you use seven --

15:53:27 4 As a midpoint, you said?

15:53:29 5 A. Well it's not the exact midpoint, but it's

15:53:31 6 between the two.

15:53:32 7 Q. And why would you use -- why would you want

15:53:34 8 to use the midpoint?

15:53:37 9 A. I've done work on -- peer-reviewed published

15:53:40 10 work on the Boussinesq model, and what we showed is

15:53:43 11 that when -- even for temperature variations in a room

15:53:46 12 of 150 Celsius, that if you use a temperature at or

15:53:52 13 near the midpoint you'll get very accurate results.

15:53:55 14 Q. Would it --

15:53:56 15 Just so I understand, is -- is the

15:54:00 16 temperature used in the Boussinesq, would that be

15:54:02 17 equivalent to the buoyancy reference temperature?

15:54:05 18 A. It is my --

15:54:06 19 I believe it is, --

15:54:06 20 Q. Okay.

15:54:07 21 A. -- but I'd have to check the manual.

15:54:09 22 Q. Okay. And how would that affect the

15:54:10 23 calculations?

15:54:14 24 A. It affects the calculations in a couple

15:54:16 25 ways. First of all, it mean -- as you pointed out

15:54:21       1   earlier, warmer air is less dense than cooler air. So  
15:54:28       2   the air coming out of the Bair Hugger blanket, which I  
15:54:33       3   used as 41, is less dense than air coming out of the  
15:54:38       4   ceiling. By using a reference temperature that is  
15:54:43       5   between the two what I did is I made a worst-case  
15:54:48       6   scenario in that the density of air coming out of the  
15:54:50       7   Bair Hugger was higher than it actually is in real  
15:54:53       8   life and the density of the air coming out of the  
15:54:57       9   ceiling is lower. And what that means is I gave the  
15:55:01      10   Bair Hugger air more momentum.

15:55:03       11           So, for example, let's think of this as a  
15:55:07       12   car and a train having a collision. The momentum  
15:55:11       13   coming out of the ceiling is 60 times that of the Bair  
15:55:17       14   Hugger, so it's like a train hitting a car, train  
15:55:20       15   hitting a sedan, let's say. By using the Boussinesq  
15:55:24       16   model I made my sedan a little heavier, I made it an  
15:55:28       17   SUV, just to make it a worst-case scenario.

15:55:32       18           Q.   So say you lowered the buoyancy reference  
15:55:35       19   temperature to 50, how would that affect your model?

15:55:42       20           MR. GOSS: 50 Fahrenheit?

15:55:43       21           MR. ASSAAD: 50 Fahrenheit.

15:55:47       22           A.   It would make the density of the air in the  
15:55:48       23   room higher.

15:55:52       24           Q.   Okay. You could have used ideal gas instead  
15:56:22       25   of Boussinesq; correct?

15:56:23 1 A. That is correct.

15:56:25 2 Q. Okay. And just so I'm absolutely sure, you

15:56:37 3 ran one run as RANS on the 750 and one run as LES;

15:56:43 4 correct?

15:56:44 5 A. No.

15:56:47 6 Q. On the 750.

15:56:49 7 A. All the results here, all the unsteady

15:56:51 8 results were LES.

15:56:53 9 Q. I understand that, but you ran one run of

15:56:56 10 RANS to get your initial conditions, and then you ran

15:56:59 11 one run of LES.

15:57:01 12 A. I believe that's true. I don't recall

15:57:03 13 exactly, but I'm pretty confident that is correct.

15:57:16 14 Q. Do you agree with me that the ideal gas is

15:57:19 15 more accurate than the Boussinesq?

15:57:23 16 A. It is more accurate, but it's not a

15:57:25 17 worst-case calculation, which is why I chose

15:57:28 18 Boussinesq.

15:57:37 19 Q. But it's more accurate; correct?

15:57:40 20 A. Correct.

15:58:04 21 Q. Do you agree that Dr. Elghobashi is an

15:58:06 22 expert in particle flow in turbulent air?

15:58:12 23 A. I would agree he's an expert on spherical

15:58:16 24 particles in perhaps high-speed flows for sure. I

15:58:21 25 don't know if I'd generally agree he's an expert in

15:58:24 1 particle flow in air.

15:58:26 2 Q. Would you -- Would you --

15:58:28 3 Would you consider yourself a particle

15:58:29 4 expert in high-speed flows?

15:58:32 5 A. No.

15:58:33 6 Q. Would you consider yourself an expert in low

15:58:35 7 -- with particles in low-speed flows?

15:58:38 8 A. Probably not.

15:58:40 9 Q. Okay. Have you ever done any work for the

15:58:46 10 Department of Defense?

15:58:48 11 A. Via a subcontractor, yes.

15:58:52 12 Q. What about directly with the Department of

15:58:54 13 Defense?

15:58:54 14 A. No.

15:58:55 15 Q. Have you done any work with the -- with any

15:58:58 16 part of the military?

15:59:01 17 A. No.

15:59:02 18 Q. Do you have access to the military

15:59:03 19 supercomputer?

15:59:04 20 A. No.

15:59:05 21 Q. Do you have access to a computer that could

15:59:07 22 do DNS modeling?

15:59:09 23 A. Yes.

15:59:10 24 Q. What computer?

15:59:12 25 A. The ANSYS model, the ANSYS software has the

15:59:15 1 capability of doing D -- DNS if you set a term in the  
15:59:20 2 LES model to zero. I wouldn't use DNS for this case.  
15:59:26 3 Q. No one could use DNS for this case.  
15:59:29 4 A. I don't know --  
15:59:30 5 MR. GOSS: Wait for a question.  
15:59:32 6 Q. Do you agree with that?  
15:59:33 7 Can anyone do DNS for this case?  
15:59:36 8 A. I would have to calculate how many elements  
15:59:39 9 would be needed to record -- to do the calculation, but  
15:59:43 10 sitting here now I think it's unlikely someone would  
15:59:46 11 do DNS for this.  
15:59:48 12 Q. Do you know --  
15:59:51 13 Have you ever done DNS?  
15:59:52 14 A. No.  
16:00:03 15 Q. Do you know what type of computing is  
16:00:05 16 required to run DNS?  
16:00:09 17 A. What do you mean by "computing"?  
16:00:11 18 Q. What size computer, how many cores?  
16:00:13 19 A. It depends on the size of the problem and  
16:00:16 20 the number of elements.  
16:00:19 21 Q. You agree that DNS is the most accurate form  
16:00:23 22 -- method of computational fluid dynamics.  
16:00:26 23 A. It is generally considered the most  
16:00:28 24 accurate.  
16:00:29 25 Q. And in fact it's probably more accurate than

16:00:31 1 experimental measurements.

16:00:33 2 A. I would disagree with that.

16:00:35 3 Q. You'd disagree with that?

16:00:36 4 A. Yes.

16:00:37 5 Q. Okay.

16:00:54 6 MR. ASSAAD: Let's take a break.

16:00:55 7 THE REPORTER: Off the record, please.

16:00:57 8 (Recess taken from 4:00 to 4:13 p.m.)

16:13:42 9 BY MR. ASSAAD:

16:13:59 10 Q. Are you aware of any peer-reviewed

16:14:04 11 literature that has modeled an operating room?

16:14:11 12 A. Yes.

16:14:12 13 Q. Is that the Farhad Memarzadeh literature?

16:14:15 14 A. That is one. There may be others that I

16:14:18 15 can't think of, but that's one of them.

16:14:20 16 Q. And you agree with me that Farhad Memarzadeh

16:14:22 17 used the RANS model; correct?

16:14:24 18 A. Yes.

16:14:24 19 Q. Okay. He didn't use LES; correct?

16:14:26 20 A. Correct.

16:14:26 21 Q. And are you aware of any peer-review

16:14:29 22 literature that gave -- that included no solids in

16:14:34 23 their CFD model?

16:14:38 24 MR. GOSS: Of an operating room, or more

16:14:40 25 generally?

16:14:41 1 Q. In the operating room.

16:14:41 2 A. Sitting here now, no.

16:14:44 3 Q. Well you had no solids; correct?

16:14:45 4 A. That is correct.

16:14:46 5 Q. Okay. Now you agree with me that I could

16:15:31 6 try to run a model and get the same results as you can

16:15:38 7 without having your initial conditions; correct?

16:15:41 8 A. Yes.

16:15:42 9 Q. Your opinion is that you don't believe that

16:15:44 10 I need the initial conditions to obtain reproducible

16:15:49 11 results in this model; correct?

16:15:51 12 A. Correct.

16:15:51 13 Q. Okay. However, you would agree with me that

16:15:56 14 for me to verify that you had used the proper initial

16:16:07 15 conditions I would need to know what the initial

16:16:09 16 conditions are; correct?

16:16:12 17 A. I would disagree that there is such a thing

16:16:14 18 as "proper initial conditions."

16:16:16 19 Q. For me to verify your initial conditions I

16:16:19 20 would need to know the initial conditions; correct?

16:16:22 21 A. I would a -- I would agree for you to know

16:16:23 22 my initial conditions you would have to know the

16:16:25 23 initial conditions.

16:16:26 24 Q. Okay. And for me to determine whether or

16:16:29 25 not there is quasi-steady solution with respect to

16:16:36 1 your CFD model, I would have to know the initial  
16:16:39 2 conditions.

16:16:44 3 A. I don't know if that's true.

16:16:50 4 Q. Well do you know that it's not true?

16:16:53 5 A. Well let's say you ran your own code and  
16:16:55 6 let's say you obtained initial -- quasi-steady results  
16:16:59 7 and compared them with mine. If yours were the same  
16:17:03 8 then you had reached quasi-steady results.

16:17:05 9 Q. What if mine were different?

16:17:08 10 A. Then you may not have quasi-steady results.

16:17:12 11 Q. Or you might not have quasi-steady results;  
16:17:14 12 correct?

16:17:15 13 A. That could be.

16:17:16 14 Q. And for me to determine that I would need  
16:17:18 15 the initial conditions to determine whether I had  
16:17:23 16 quasi -- you had quasi-steady results or I had  
16:17:25 17 quasi-steady results, and if we both came to different  
16:17:29 18 results then we might have to look further at the  
16:17:32 19 problem; correct?

16:17:33 20 A. I would agree. If we came to different  
16:17:35 21 results we'd have to look further.

16:17:37 22 Q. Okay. So there is a possibility, without  
16:17:39 23 the initial conditions, that I may never be able to  
16:17:43 24 determine whether or not your results show a  
16:17:51 25 quasi-steady solution if I cannot come to a

16:17:54 1 quasi-steady solution in my results; correct?

16:17:57 2 MR. GOSS: Calls for speculation.

16:17:59 3 A. That's a complex --

16:18:00 4 Could you re -- rephrase it, re-ask it?

16:18:02 5 Q. Well just assume that I -- I run your model

16:18:04 6 and I cannot come to a quasi-steady solution, okay? I

16:18:09 7 could determine whether or not you came to a

16:18:11 8 quasi-steady solution if I had your initial -- your

16:18:15 9 initial conditions and your final result; correct?

16:18:27 10 A. It's a --

16:18:29 11 That was a very cumbersome question. Could

16:18:31 12 you just --

16:18:31 13 Q. Let's make it: I cannot independently

16:18:33 14 verify that you have -- your solution is a

16:18:37 15 quasi-steady solution without another TRN file or even

16:18:42 16 -- or the initial conditions; correct?

16:18:44 17 A. You could not verify that my results were

16:18:47 18 quasi-steady without another TRN file.

16:18:50 19 Q. And, I mean, these are transient results,

16:18:53 20 TRN files; correct?

16:18:54 21 A. Correct.

16:18:55 22 Q. And all transient results are dependent on

16:18:59 23 the initial conditions.

16:18:59 24 A. That is correct.

16:19:00 25 Q. Okay. So your failure to provide the

16:19:10 1 initial conditions prevents my independent  
16:19:15 2 verification of your CFD. You agree?

16:19:17 3 A. I disa --

16:19:18 4 MR. GOSS: Object to form.

16:19:19 5 A. I disagree.

16:19:21 6 Q. I can't verify your CFD to determine whether  
16:19:22 7 or not you have quasi-steady solution based on your  
16:19:26 8 one TRN value.

16:19:27 9 MR. GOSS: Asked and answered.

16:19:28 10 A. I disagree.

16:19:29 11 Q. You disagree to that now?

16:19:31 12 A. Yes.

16:19:32 13 Q. Okay. You told me before I need at least  
16:19:35 14 two TRNs to determine whether or not a solution is --  
16:19:38 15 is a quasi-steady solution.

16:19:43 16 A. You need two --

16:19:46 17 Let's take a step back and make sure it's  
16:19:48 18 totally clear, and I want to make sure that I'm not  
16:19:50 19 confused.

16:19:51 20 If you want to know whether your results are  
16:19:59 21 quasi-steady you can do it a number of different ways.  
16:20:04 22 You can compare the results to an experiment that's  
16:20:08 23 quasi-steady, you could compare two sets of TRN files,  
16:20:13 24 which is what you mentioned, or you could compare  
16:20:18 25 someone else's calculations that are quasi-steady. So

16:20:23 1 there's different ways of doing it. But -- But I  
16:20:26 2 would agree with you to know if this set of results  
16:20:28 3 right here is quasi-steady [indicating Exhibit 1] you  
16:20:32 4 would want to compare two different TRN files.

16:20:34 5 Q. Okay. Because you didn't compare your  
16:20:36 6 results to anyone else's results; correct?

16:20:38 7 A. I did not --

16:20:39 8 Well I compared my results to an experiment.

16:20:42 9 Q. Okay. But I'm talking about your  
16:20:43 10 computational fluid -- your mathematical results.

16:20:47 11 A. Correct.

16:20:48 12 Q. Okay. For example, if I wanted someone on  
16:21:27 13 my team to -- Well, strike that.

16:21:41 14 Part of the methodology in doing CFD is to  
16:22:21 15 have a proper model; correct?

16:22:25 16 A. Yes.

16:22:26 17 Q. Proper boundary conditions; correct?

16:22:28 18 A. Yes.

16:22:28 19 Q. And you need to put in initial conditions;  
16:22:31 20 correct?

16:22:32 21 A. That is correct.

16:22:33 22 Q. Okay. Without the initial --

16:22:36 23 That is mandatory in a CFD analysis is

16:22:40 24 having initial conditions; correct?

16:22:42 25 A. That is correct.

16:22:43 1 Q. And you have not provided the initial  
16:22:44 2 conditions to the plaintiff in this case; correct?

16:22:48 3 MR. GOSS: Asked and answered multiple,  
16:22:49 4 multiple times.

16:22:52 5 A. That is correct.

16:22:53 6 Now you can get the same results by having  
16:22:57 7 different initial conditions.

16:22:59 8 Q. But the methodology requires initial  
16:23:01 9 conditions; correct?

16:23:01 10 A. The methodology requires initial conditions,  
16:23:04 11 it doesn't require the same ones.

16:23:05 12 Q. Let's go to your CFD model.

16:23:21 13 (Discussion off the stenographic record.)  
16:23:31 14 (Files brought up on a projector.)

16:23:31 15 BY MR. ASSAAD:

16:23:31 16 Q. Now I'm going to represent to you that the  
16:23:34 17 name of this file is Abraham 0000001, which is a Bates  
16:23:40 18 number that -- your TRN file that is TRN 264.

16:23:50 19 MR. GOSS: Can you -- I'm not suggesting  
16:23:51 20 that it isn't that, but can you give us, at the end  
16:23:54 21 of the deposition, a thumb-drive copy?

16:23:55 22 MR. ASSAAD: Is there any way we can go to  
16:23:57 23 the 264 TRN -- dot TRN number?

16:24:02 24 (Screen being manipulated.)

16:24:02 25 MR. GOSS: And I don't -- I don't question

16:24:04 1 that it is, it's just can we get a copy of the file  
16:24:07 2 after the deposition?

16:24:08 3 MR. ASSAAD: It's your file. So yeah, I  
16:24:10 4 can give it back to you.

16:24:11 5 MR. GOSS: That's fine. Just so I can  
16:24:13 6 verify.

16:24:15 7 BY MR. ASSAAD:

16:24:15 8 Q. Okay. Up there --  
16:24:17 9 And if you want to stand up and look closer,  
16:24:20 10 feel free, but it says 264. And I represent that this  
16:24:26 11 is your TRN file loaded into ANSYS software.

16:24:32 12 Does this look like ANSYS software to you?

16:24:35 13 A. Yes.

16:24:39 14 Q. And what I have here is the temperature  
16:24:42 15 difference between --

16:24:57 16 MR. ASSAAD: Let's go off the record real  
16:24:59 17 quick.

16:25:37 18 (Discussion off the record.)

16:25:37 19 BY MR. ASSAAD:

16:26:14 20 Q. I'm sorry about that. I needed to get a  
16:26:16 21 mobile microphone so I can move.

16:26:19 22 So this is your TRN file for time step 264.  
16:26:28 23 And what I've put up on the screen is the temperature  
16:26:33 24 distribution in the room with a -- a scale range of 58  
16:26:38 25 degrees Celsius to 62.

16:26:40 1 Do you see that?

16:26:40 2 A. Yes.

16:26:41 3 Q. Okay. Does that look about right?

16:26:43 4 A. I never provided a plot or looked at a plot

16:26:46 5 with this temperature range, so I can't co -- I can't

16:26:48 6 confirm.

16:26:49 7 Q. Okay. But you agree with me that with the

16:26:51 8 TRN file that you provided that you could go in and

16:26:54 9 get temperature ranges such as this.

16:26:56 10 A. Yes.

16:26:57 11 Q. Okay. And I represent to you that this is

16:26:59 12 the temperature range along a certain plane along the

16:27:02 13 middle -- going down the middle of the body roughly of

16:27:05 14 the temperature differences in the room.

16:27:07 15 Do you see --

16:27:07 16 MR. GOSS: I'm sorry. Is this something

16:27:09 17 that you did, or are you saying that she did it?

16:27:11 18 MS. ZIMMERMAN: This is off his --

16:27:13 19 MR. GOSS: What's that?

16:27:14 20 MR. ASSAAD: Well let me --

16:27:16 21 Q. You could produce many images off your TRN

16:27:18 22 file depending on what you're looking for; correct?

16:27:21 23 A. Correct.

16:27:21 24 Q. And this is the type of image that you could

16:27:23 25 pull off your TRN file; correct?

16:27:25 1 A. That is correct.

16:27:25 2 Q. You just do a couple clicks in ANSYS, you

16:27:28 3 tell them what you need, you draw a plane where you're

16:27:32 4 looking and you could produce this image; correct?

16:27:34 5 A. Correct.

16:27:34 6 Q. Okay. And you agree with me that when you

16:27:39 7 put the temperature max of 62, the red area is all

16:27:45 8 temperatures 62 degrees and above; correct?

16:27:47 9 A. Yes.

16:27:47 10 Q. And you agree with me that based on your

16:27:49 11 initial conditions and that the air coming from the

16:27:54 12 ceiling inlet of being 59 degrees, that the low

16:27:58 13 temperature would probably be 59 degrees in the

16:28:00 14 operating room; correct?

16:28:02 15 A. Correct.

16:28:02 16 Q. Okay. And this would be the temperature

16:28:04 17 difference between the ceiling and the floor; correct?

16:28:10 18 A. Well you're showing the temperature

16:28:11 19 distribution on a cross-section.

16:28:13 20 Q. Yes.

16:28:14 21 A. And that temperature distribution goes from

16:28:16 22 the ceiling to the floor.

16:28:17 23 Q. Okay. And you agree with me that there's

16:28:19 24 very little difference between the temperature of the

16:28:24 25 ceiling and the temperature of the floor.

16:28:30 1 A. There is a few degrees difference.

16:28:32 2 Q. Okay. And we could actually go in and pick

16:28:36 3 points and determine the temperature difference;

16:28:39 4 correct?

16:28:39 5 A. Yes.

16:28:40 6 Q. Okay. I could go pick a point up at the

16:28:41 7 ceiling and I could go pick a point up at the bottom

16:28:44 8 and it'll give me the temperature difference; correct?

16:28:46 9 A. Correct.

16:28:47 10 Q. Do you know what the temperature difference

16:28:48 11 in an operating room is between the ceiling and the

16:28:50 12 height of the operating room table?

16:28:53 13 A. No. It would depend on where you are in the

16:28:57 14 room, because the temperature difference would not be

16:29:00 15 constant. It would not be the same depending on where

16:29:04 16 you took the measurements.

16:29:05 17 But no, I do not know, as a general rule,

16:29:08 18 the temperature difference between the ceiling in the

16:29:11 19 OR.

16:29:11 20 Q. By the way, have you looked at any studies

16:29:14 21 that did temperature monitoring of an operating room

16:29:17 22 when the Bair Hugger was on as compared to the Bair

16:29:19 23 Hugger was off?

16:29:19 24 A. Yes.

16:29:20 25 Q. Would that be the Dasari study?

16:29:23 1 A. That was one.

16:29:24 2 Q. What was the other one?

16:29:26 3 A. (Witness reviewing exhibit.) If I recall

16:30:03 4 correctly, it was the Legg papers.

16:30:07 5 Q. Okay. Would you agree with me that a study

16:30:14 6 that was identical with the number of people in an

16:30:17 7 operating room, same flow, same operating room, and

16:30:20 8 the only thing that changed was whether or not the

16:30:23 9 Bair Hugger was used or not used and measured

16:30:29 10 temperature difference would indicate the temperature

16:30:31 11 rise in the operating room solely because of the Bair

16:30:32 12 Hugger?

16:30:34 13 A. Boy, that was complex.

16:30:35 14 Could you rephrase it in a shorter, tighter

16:30:37 15 --

16:30:37 16 Q. If there's a study which everything is

16:30:39 17 identical; the number of people in the room, the

16:30:42 18 airflow, the devices, the equipment, but the only

16:30:47 19 thing that changed was the Bair Hugger was on as

16:30:50 20 compared to the Bair Hugger was off, would you agree

16:30:53 21 with me that any change in the temperature in that

16:30:55 22 room would be a result of the Bair Hugger?

16:30:59 23 A. Yes.

16:30:59 24 MR. GOSS: Object to the incomplete

16:31:01 25 hypothetical.

16:31:01 1 A. Yes.

16:31:02 2 Q. Okay. And say if they were comparing two  
16:31:06 3 devices. Say, for example, the difference between the  
16:31:10 4 Bair Hugger and the HotDog, okay? Everything's  
16:31:14 5 identical except one was the Bair Hugger was on, and  
16:31:17 6 one was that the HotDog was on, would you agree with  
16:31:22 7 me that if there was a Delta T between the temperature  
16:31:25 8 measurements you could say that was as a result of the  
16:31:27 9 differences in the devices?

16:31:29 10 MR. GOSS: Same objection.

16:31:30 11 A. I would agree to this and the prior question  
16:31:34 12 with the caveat that the -- any heat generated in an  
16:31:39 13 OR may create a change in the control system of the  
16:31:41 14 HVAC. So the HVAC may turn on or off or turn higher  
16:31:45 15 or lower depending on heat, but aside from that  
16:31:47 16 caveat, I agree.

16:31:49 17 Q. Okay. And have you looked at any studies  
16:31:52 18 that show the difference in the temperature increase  
16:31:55 19 around the surgical table between the Bair Hugger and  
16:31:58 20 the HotDog?

16:32:02 21 A. Yes.

16:32:04 22 Q. What study?

16:32:09 23 A. It may -- I -- I know this isn't a memory  
16:32:12 24 test and you're not making me do a memory test. It  
16:32:16 25 could be the two I mentioned, the Legg studies. It

16:32:20        1 could be Dasari. I just don't remember which one. I  
16:32:23        2 remember that there were -- there are two studies in  
16:32:27        3 my memory that looked at temperature changes over the  
16:32:30        4 surgical site, and I believe one of them did a  
16:32:33        5 comparison of the HotDog and Bair Hugger.

16:32:39        6            Q. And do you recall that study showing that  
16:32:44        7 when the Bair Hugger was used the temperature around  
16:32:46        8 the surgical table was higher than when the HotDog was  
16:32:49        9 used?

16:32:50        10          A. Can you show me the study?

16:32:52        11          Q. I'm asking if you recall that?

16:32:53        12          A. I don't recall.

16:32:54        13          Q. Okay. Assuming that when the Bair Hugger's  
16:32:56        14 used that the temperature around the surgical site is  
16:33:01        15 higher -- or the surgical table is higher than when  
16:33:04        16 the HotDog is used and everything else stayed  
16:33:07        17 constant, what would that indicate to you as a  
16:33:09        18 scientist?

16:33:10        19          MR. GOSS: Objection, incomplete  
16:33:12        20 hypothetical.

16:33:15        21          A. I mean you're asking me to comment on a  
16:33:19        22 study that I don't have in front of me so I'd have to  
16:33:22        23 read the study.

16:33:24        24          Q. I'm just saying -- Forget about the study.  
16:33:27        25          In a hypothetical situation that you have a

16:33:30 1 HotDog --  
16:33:31 2 You know what the HotDog is?  
16:33:32 3 A. Yes.  
16:33:32 4 Q. And you have a Bair Hugger. You know what a  
16:33:34 5 Bair Hugger is; correct?  
16:33:35 6 A. Yes.  
16:33:35 7 Q. Okay. And everything else is constant  
16:33:37 8 except in one -- in certain tests the HotDog is used,  
16:33:41 9 and in other certain tests the Bair Hugger is used,  
16:33:46 10 and when you compare the results it shows a statis --  
16:33:52 11 statistic -- signi -- a statistic --  
16:33:53 12 MR. GOSS: Ly [lee].  
16:33:55 13 Q. -- statistically significant change between  
16:34:01 14 the Bair Hugger and the HotDog showing that the Bair  
16:34:04 15 Hugger warms the air around the operating room table  
16:34:06 16 more than the HotDog.  
16:34:08 17 Assuming those facts, what does that mean to  
16:34:11 18 you as a scientist as to the effect of the Bair Hugger  
16:34:13 19 compared to the HotDog on the temperature around the  
16:34:17 20 surgical table?  
16:34:18 21 MR. GOSS: Same objection, assumes facts  
16:34:19 22 not in evidence.  
16:34:20 23 A. If that is correct, and part of the reason  
16:34:23 24 why I'm tentatively answering this is there have been  
16:34:28 25 multiple studies that I've read that actually show

16:34:31       1 conflicting measurements of temperature above the  
16:34:33       2 table, they show different values, so I wouldn't  
16:34:38       3 assume that that study is correct. But if it is  
16:34:41       4 correct, one interpretation may be that there is heat  
16:34:46       5 from the Bair Hugger that is entering the air. That's  
16:34:49       6 one possibility.

16:34:50       7 Q.     What's the other possibility?

16:34:54       8 A.     There is -- could be draping, it could be  
16:34:56       9 the measurement method is different. I would have to  
16:34:58       10 look at the study. You're asking me to comment --

16:35:00       11 Q.     Well when you compare --

16:35:01       12 MR. GOSS: Hold on. Let him finish his  
16:35:03       13 answer.

16:35:04       14 A.     You're asking me to comment on a study that  
16:35:06       15 I don't see, and I know that there are multiple  
16:35:08       16 studies that are conflicting on these very types of  
16:35:11       17 measurements that you've made.

16:35:12       18 Q.     With respect to temperature measurements?

16:35:13       19 A.     Yes.

16:35:14       20 Q.     Okay. We'll get to that in a second.

16:35:17       21           But if everything is constant; where the  
16:35:25       22 temperature measurements are taken, the airflow, the  
16:35:29       23 number of people, okay? There's no change. The only  
16:35:32       24 thing that's changed is the HotDog and the Bair  
16:35:34       25 Hugger, and the Bair Hugger shows an increase in

16:35:36 1 temperature around the operating room table more than  
16:35:39 2 the HotDog, you would agree with me that the increase  
16:35:42 3 in temperature over the operating room table is most  
16:35:46 4 likely due to the heat coming from the Bair Hugger.

16:35:49 5 MR. GOSS: Objection, incomplete  
16:35:50 6 hypothetical.

16:35:51 7 A. It's possible, but there are other  
16:35:53 8 alternative explanations.

16:35:55 9 Q. Are there other heat sources that -- that --

16:35:58 10 A. Yes.

16:35:58 11 Q. -- are different if I say everything else is  
16:36:00 12 constant besides the Bair Hugger and the HotDog?

16:36:03 13 MR. GOSS: Same objection.

16:36:04 14 A. Let me give you two options. Let me give  
16:36:08 15 you just two alternatives to show that it's not a  
16:36:10 16 simple question without seeing the study in front of  
16:36:12 17 me.

16:36:13 18 Let's say the Bair Hugger initiated less of  
16:36:20 19 a temperature response in the HVAC system and that  
16:36:26 20 lesser response meant that there was less airflow  
16:36:29 21 coming out of the vents. That could be a reason.

16:36:31 22 Q. Is it your understanding that the mass flow  
16:36:35 23 out of the vents in an operating room can change?

16:36:39 24 A. It may. I would have to see the H -- the  
16:36:41 25 control system, but it could.

16:36:43 1 Q. Do you know the entire purpose of the  
16:36:46 2 unidirectional airflow is a constant velocity of air  
16:36:50 3 being -- coming out of the inlets over the surgical --  
16:36:55 4 over the surgical table. You understand that;  
16:36:57 5 correct?  
16:36:57 6 A. I do not understand --  
16:36:58 7 MR. GOSS: Object to form.  
16:37:00 8 A. I do not understand that.  
16:37:01 9 Q. You're not aware of that fact?  
16:37:03 10 MR. GOSS: Object to form.  
16:37:04 11 A. What I understand --  
16:37:05 12 Q. Are you not aware of that fact?  
16:37:06 13 MR. GOSS: Same objection.  
16:37:06 14 A. Are you saying constant in time or constant  
16:37:08 15 in space?  
16:37:09 16 Q. Well you -- you take the face velocity of I  
16:37:21 17 believe 39 feet per sec -- feet cubed per second. Do  
16:37:24 18 you recall that?  
16:37:24 19 A. Yes. That is not a face velocity, but yes,  
16:37:26 20 I recall that number.  
16:37:29 21 Q. You're right, it's not. It's a volumetric  
16:37:31 22 velocity.  
16:37:32 23 Do you believe that number changes over time  
16:37:36 24 in an operating room?  
16:37:40 25 A. Certainly it would. There is no perfect

16:37:46 1 ventilation system where the flow is always the exact  
16:37:49 2 same value.

16:37:50 3 Q. I understand that it's a tolerance and  
16:37:53 4 there's going to be a deviation, but do you -- do you  
16:37:57 5 believe that the controls of the HVAC system in an  
16:38:00 6 operating room may change the volumetric flow?

16:38:03 7 A. I don't know the answer to that --

16:38:05 8 Q. Okay.

16:38:05 9 A. -- but it -- they may.

16:38:06 10 Q. But you don't know sitting here today.

16:38:08 11 A. Correct.

16:38:09 12 Q. So again I don't want you to guess, so you  
16:38:10 13 could say "I don't know"; right? You can say those --  
16:38:13 14 You know how to say "I don't know." If you don't  
16:38:16 15 know, you don't know; correct?

16:38:16 16 A. I do know how to say I don't know.

16:38:19 17 Q. Okay. Now let's look at your 3D model, and  
16:38:31 18 --

16:38:31 19 MR. ASSAAD: Can you put up the boundary  
16:38:33 20 condition for the outlet...

16:38:57 21 (Discussion off the stenographic record.)

16:39:17 22 (Change in projected image.)

16:39:17 23 MR. GOSS: Are we in ANSYS right now?

16:39:20 24 MR. ASSAAD: Let me ask the doctor.

16:39:22 25 BY MR. ASSAAD:

16:39:22 1 Q. Doctor, does this look like ANSYS?  
16:39:24 2 A. Yes.  
16:39:25 3 Q. Do you have any dispute that this is not  
16:39:27 4 ANSYS?  
16:39:27 5 A. No.  
16:39:28 6 MR. GOSS: I'm not disputing it, I just  
16:39:30 7 wanted to know.  
16:39:31 8 Q. Do you agree that --  
16:39:34 9 MR. ASSAAD: Turn it so I can see --  
16:39:36 10 Q. Do you agree that the red area is the  
16:39:38 11 boundary condition for the Bair Hugger inlet?  
16:39:46 12 A. I do.  
16:39:47 13 Q. Okay. And you agree that's mostly coming  
16:39:50 14 from the back -- underneath the drape and the back of  
16:39:55 15 the patient.  
16:39:56 16 A. I do, which reminds me that I gave an  
16:39:59 17 incorrect answer earlier today where I had recalled it  
16:40:02 18 came from both. But seeing it re -- seeing it here,  
16:40:07 19 it's clearly predominantly the back.  
16:40:10 20 Thank you.  
16:40:10 21 Q. Now we could agree that the -- the -- I  
16:40:20 22 mean, you might remember and not remember stuff, we  
16:40:23 23 always can go back to the TRN file to get the geometry  
16:40:25 24 and the mesh and everything; correct? And the  
16:40:28 25 boundary conditions.

16:40:28 1 A. Yes.

16:40:29 2 Q. Okay. So even though you might be

16:40:31 3 incorrect, I could rely on your TRN file for the

16:40:34 4 boundary conditions, the time step, the material

16:40:38 5 properties, the airflow, et cetera.

16:40:40 6 A. Yes.

16:40:41 7 Q. Okay. Now my understanding is that the

16:40:47 8 entire mass flow -- the entire mass flow of the Bair

16:40:57 9 Hugger unit is coming out of that area that looks --

16:41:00 10 that's red.

16:41:02 11 A. Yes.

16:41:03 12 Q. Okay. And on top of it is a drape; correct?

16:41:08 13 A. Correct.

16:41:09 14 Q. And the drape -- the drape is adiabatic;

16:41:13 15 correct? You set it as adiabatic.

16:41:16 16 A. Correct.

16:41:17 17 Q. Therefore there's no heat transfer from that

16:41:20 18 Bair Hugger inlet to the drape; correct?

16:41:23 19 A. Correct.

16:41:24 20 Q. And that's not what happens in real life;

16:41:26 21 correct?

16:41:26 22 A. That is different from real life.

16:41:28 23 Q. So -- Okay. Real life there'll be some heat

16:41:32 24 transfer and actually convective -- or plumes above

16:41:38 25 the drape; correct? There'll be convective currents

16:41:44 1 above the drape as a result of the change in  
16:41:46 2 temperature of the drape.

16:41:46 3 A. I disagree.

16:41:47 4 Q. You disagree?

16:41:48 5 A. Yes.

16:41:49 6 Q. Okay. So you disagree with Gary Settles,  
16:41:54 7 who did schlieren testing that showed that there was  
16:41:58 8 thermal convection above the drape.

16:42:01 9 A. Well there's thermal convection everywhere  
16:42:03 10 in the room.

16:42:04 11 Q. Okay. But you disagree that the Bair Hugger  
16:42:07 12 caused thermal convection above the drape as Gary  
16:42:11 13 Settles has testified.

16:42:12 14 MR. GOSS: Objection, lack of foundation.

16:42:14 15 A. When you --

16:42:15 16 MR. GOSS: If you know, you can answer.

16:42:16 17 A. When you use the words "thermal convection"  
16:42:19 18 and "above the drape," what do you mean by "above the  
16:42:22 19 drape"?

16:42:22 20 Q. Okay. The Bair Hugger is going to heat the  
16:42:24 21 drape, correct, in real life.

16:42:26 22 A. It may.

16:42:27 23 Q. Okay. The Bair Hugger air is coming out at  
16:42:31 24 41 degrees Celsius according to what you've put down;  
16:42:34 25 correct?

16:42:35 1 A. Correct.

16:42:35 2 Q. And the drape is a cloth drape, a surgical

16:42:40 3 drape; correct?

16:42:41 4 A. Correct.

16:42:42 5 Q. You would agree by the law of thermodynamics

16:42:45 6 that there'll be -- and heat transfer that there's

16:42:48 7 going to be some heat transfer to the drape; correct?

16:42:57 8 A. Pardon me. (Witness reviewing exhibit.)

16:42:59 9 Q. I'm not talking about your report here.

16:43:01 10 Let's just talk about engineering principles.

16:43:04 11 MR. GOSS: Okay. But if he needs to refer

16:43:06 12 to his report to answer --

16:43:07 13 MR. ASSAAD: I am not talking about his

16:43:08 14 report, sir. I'm talking about this picture up here

16:43:10 15 and common heat transfer.

16:43:12 16 MR. GOSS: You have plenty of time left on

16:43:14 17 the tape to get an answer. You can answer when

16:43:16 18 you're ready.

16:43:16 19 MR. ASSAAD: Okay.

16:43:17 20 A. If sufficient amount of warm air presses

16:43:22 21 against -- touches that drape, then I agree there

16:43:26 22 would be heat transfer between the air and the drape.

16:43:31 23 Q. Did you look at the drapes actually? Did

16:43:34 24 you touch the drapes?

16:43:36 25 A. Yes.

16:43:37 1 Q. The drapes are -- they have no form to them,  
16:43:39 2 they're just like a drape, like a blanket; correct?  
16:43:42 3 A. Correct.  
16:43:42 4 Q. Okay. And when you put the drape on a  
16:43:46 5 patient do you get that same type of nice curvature  
16:43:50 6 shape that has an open area to the back of the  
16:43:53 7 patient?  
16:43:55 8 A. No.  
16:43:56 9 Q. Okay.  
16:43:56 10 A. It is not exactly that shape.  
16:43:58 11 Q. Okay. Because gravity is going to be  
16:44:00 12 pulling that drape down; correct? Unless something's  
16:44:03 13 holding it up.  
16:44:05 14 A. Well the drape is held up by clips.  
16:44:09 15 Q. Not that drape. That drape -- I don't see  
16:44:13 16 any clips here on this drape. This drape, the white  
16:44:17 17 line is held up by clips; correct?  
16:44:19 18 A. I agree. I thought that's the drape we were  
16:44:21 19 talking about.  
16:44:22 20 Q. This drape I'm talking about here.  
16:44:23 21 [Indicating.] This drape is not being held up by  
16:44:25 22 anything; correct?  
16:44:27 23 A. It's hard for me to identify a different  
16:44:30 24 drape than that drape in this image. I mean, I would  
16:44:40 25 -- look, I would agree with you that the exact shape

16:44:42 1 of that inlet --

2 (Screen image modified.)

16:44:44 3 THE WITNESS: Thank you.

16:44:46 4 A. I would agree with you that the exact shape  
16:44:48 5 of that inlet shown in red would differ slightly from  
16:44:53 6 in actual practice. I agree.

16:44:55 7 Q. "Slightly"? Or --

16:44:56 8 Do you know, sitting here today?

16:44:58 9 A. Well I will say this. I don't think the cha  
16:45:01 10 -- the difference would have a material impact on the  
16:45:03 11 results.

16:45:04 12 Q. I understand that's your opinion, sir. But  
16:45:05 13 let's just not make --

16:45:07 14 I don't want to know about what your  
16:45:08 15 opinions on the results. I just want to know, do you  
16:45:10 16 know whether or not that drape shape is accurate,  
16:45:13 17 sitting here today?

16:45:14 18 A. That drape shape would not be perfectly  
16:45:16 19 accurate.

16:45:16 20 Q. Okay. Did you take any measurements of the  
16:45:19 21 shape, or pictures?

16:45:21 22 A. No.

16:45:22 23 Q. And in fact you did not even create this;  
16:45:25 24 did you?

16:45:26 25 A. Correct.

16:45:27 1 Q. Okay.

16:45:27 2 A. I did not create it.

16:45:28 3 Q. 3M created this; correct?

16:45:30 4 A. 3M created the geometry.

16:45:32 5 Q. Which is the shape of the -- of the Bair

16:45:34 6 Hugger inlet.

16:45:34 7 A. Yes.

16:45:35 8 Q. Okay. You never did any measurements, you

16:45:39 9 yourself or anyone on your team, to determine the

16:45:41 10 shape of the Bair Hugger inlet; correct?

16:45:43 11 A. That is correct.

16:45:44 12 Q. Okay. So sitting here today, you cannot

16:45:51 13 independently verify the shape of that Bair Hugger

16:45:56 14 inlet, you're relying on what 3M has provided to you.

16:46:00 15 A. I relied, for the three dimensional object

16:46:06 16 -- all the three dimensional objects, on what 3M

16:46:08 17 provided to me.

16:46:09 18 Q. So you, sitting here today, cannot

16:46:11 19 independently verify that shape, you are relying on

16:46:13 20 what 3M has provided to you.

16:46:14 21 MR. GOSS: Asked and answered.

16:46:15 22 A. Correct.

16:46:15 23 Q. Okay. Now based on this geometry it was 3M

16:46:28 24 that came up with the assumption of the Bair Hugger

16:46:31 25 inlet; correct?

16:46:32 1 A. No.

16:46:35 2 Q. "No"?

16:46:36 3 A. That was my decision.

16:46:39 4 Q. If you look at the geometry file provided by

16:46:42 5 3M, that red area is titled "Bair Hugger inlet";

16:46:45 6 correct?

16:46:48 7 A. I don't know if it is. But the decision to

16:46:51 8 have the hot air enter into the room from that surface

16:46:56 9 was my decision regardless of the name on the file.

16:47:00 10 Q. Okay. But did you change the Bair Hugger

16:47:04 11 inlet if 3M created it?

16:47:06 12 A. I did not change the Bair Hugger inlet.

16:47:08 13 Q. So you accepted their --

16:47:09 14 You looked at what they did and you

16:47:12 15 determined that that assumption is correct.

16:47:14 16 A. I determined that that assumption is

16:47:16 17 reasonable, yes.

16:47:17 18 Q. Okay. And by "reasonable" you mean correct.

16:47:20 19 A. Correct enough to --

16:47:21 20 Q. Okay.

16:47:22 21 A. -- answer the question I was trying to

16:47:24 22 answer.

16:47:24 23 Q. Okay.

16:47:24 24 (Discussion off the stenographic record.)

16:47:49 25 Q. You agree with me that this is -- what's

16:47:52        1     shown up on the screen is a depiction of a patient in  
16:47:55        2     a hip arthroplasty surgery.

16:47:58        3     A.     Yes.

16:47:59        4     Q.     Okay. And that is when he's on the side and

16:48:02        5     both of his hands are pointed, and in this case to the

16:48:05        6     left direction.

16:48:07        7     A.     Correct. Or her hands. Correct.

16:48:08        8     Q.     Her hands. I apologize.

16:48:12        9           To play it safe I'll use "the patient's

16:48:17        10      hands."

16:48:17        11      And the Bair Hugger blanket is going over

16:48:24        12      the entire -- Rephrase that.

16:48:27        13      On the right-hand side the Bair Hugger

16:48:29        14      blanket, we can agree, is being tucked in underneath

16:48:32        15      the table, or the pad.

16:48:35        16      A.     Correct.

16:48:35        17      Q.     And on the left-hand side we agree that the

16:48:37        18      Bair Hugger blanket is being -- is going over the --

16:48:39        19      the arms of the patient; correct?

16:48:41        20      A.     Correct.

16:48:42        21      Q.     And it's being tied down; correct?

16:48:44        22      A.     Correct.

16:48:45        23      Q.     Okay. And just so I understand, it is your

16:48:51        24      assumption that no matter where the air comes out of

16:48:54        25      the Bair Hugger that it ends up coming out of the area

16:48:58 1 that's red.

16:48:59 2 A. Yes.

16:49:00 3 Q. Okay. So if I could look from underneath  
16:49:07 4 this table and I see an opening to where the arms are,  
16:49:11 5 you're saying that no air is -- no hot air is going to  
16:49:14 6 come down the side of this drape over here  
16:49:17 7 [indicating].

16:49:18 8 A. It is highly unlikely.

16:49:20 9 Q. What's your scientific basis behind that?

16:49:24 10 A. As I've explained earlier in this  
16:49:26 11 deposition, the way this device works in a setup like  
16:49:30 12 this is the arms are out, could be two arms or it  
16:49:35 13 could be one arm. The Bair Hugger is in a blanket  
16:49:38 14 that is inflated with warm air and there are tubes  
16:49:42 15 that run along the arm. Those tubes wrap around the  
16:49:47 16 arm, and that wrapping is facilitated by the covering,  
16:49:52 17 the cotton blanket and the other draping. Out of that  
16:49:57 18 Bair Hugger blanket small jets of air hit the skin and  
16:50:01 19 then essentially stop, so you have a stagnant zone of  
16:50:07 20 warm air. It is my professional opinion -- Well it's  
16:50:14 21 more than my professional opinion that that stagnant  
16:50:18 22 air wants to rise. It is my professional opinion that  
16:50:20 23 it takes, as one of the other experts said, the path  
16:50:22 24 of least resistance and it will want to go along a  
16:50:25 25 vertical channel, and that would be along the arm

16:50:29       1 because there are channels, there are spaces, and then  
16:50:32       2 out through the head and neck area. Now --  
16:50:35       3 Q.     Do you take into --  
16:50:36       4           While you answer this question do you take  
16:50:38       5 into account that it's -- there's still jets of air  
16:50:42       6 pushing down at all times?  
16:50:43       7 A.     Yes.  
16:50:44       8 Q.     Okay.  
16:50:48       9 MR. GOSS: Were you finished with your  
16:50:50      10 earlier answer?  
16:50:51      11 THE WITNESS: What I was going to add is  
16:50:53      12 that it is likely, and I would say certain, that the  
16:50:59      13 warm air would emerge from an area which may not be  
16:51:03      14 identical to that red area exactly, but it would be  
16:51:07      15 close enough so that the calculations are valid.  
16:51:34      16 Q.     And that is the assumption that there is an  
16:51:39      17 opening where that red is for the air to escape;  
16:51:41      18 correct?  
16:51:42      19 A.     Incorrect. What I said in my statement was  
16:51:46      20 that the air would travel up the natural channels that  
16:51:49      21 exist between the blanket and the body and it would  
16:51:52      22 emerge by the head or neck area. I concede, and I  
16:51:55      23 conceded in my last answer, that the area through  
16:51:59      24 which the air ultimately enters the room would likely  
16:52:03      25 not be exactly that red area. In fact some of that

16:52:07 1 air would emerge by the chest and neck, by the chin.  
16:52:12 2 So there would be some differences, but they would be  
16:52:14 3 immaterial to the results of the analysis.  
16:52:16 4 Q. Would you agree with me, though -- I mean  
16:52:18 5 you've seen Gary Settles' measurements; correct?  
16:52:21 6 A. Yes.  
16:52:21 7 Q. And when the Bair Hugger was turned on, and  
16:52:25 8 this was in a warehouse with no people around, that  
16:52:29 9 the temperature underneath the operating room table  
16:52:31 10 increased.  
16:52:32 11 MR. GOSS: Objection to form, lack of  
16:52:34 12 foundation, misstates the evidence.  
16:52:37 13 A. I think what he said is the temperature  
16:52:39 14 underneath the drapes and perhaps underneath the  
16:52:42 15 arm-boards, but I would a -- with that caveat, I would  
16:52:45 16 agree.  
16:52:46 17 Q. So if the temperature under the arm-boards  
16:52:47 18 increased, that means the heat is -- not all the  
16:52:52 19 heat's going up through the channels and out the area  
16:52:55 20 that you say it goes out; correct?  
16:52:57 21 A. It is correct that not all the heat, but  
16:53:00 22 let's not confuse "heat" with "air."  
16:53:02 23 Q. Okay. Well maybe that's where our issue is  
16:53:05 24 here, and maybe we're coming to the final, like, area  
16:53:08 25 we disagree.

16:53:09 1 Just because air travels up doesn't mean all  
16:53:14 2 of the heat is transferring with the air to -- to the  
16:53:18 3 -- not all the heat's being exited out of the red area  
16:53:21 4 here on the diagram; correct?  
16:53:22 5 A. I agree.  
16:53:23 6 Q. Okay. In fact, in real life heat's going to  
16:53:26 7 be transferred to the drapes around it; correct?  
16:53:30 8 A. Could be.  
16:53:31 9 Q. It's going to be transferred definitely to  
16:53:32 10 the patient, because that's the purpose of the Bair  
16:53:34 11 Hugger.  
16:53:35 12 A. Yes.  
16:53:35 13 Q. Okay. It's going to be transferred to  
16:53:37 14 probably the arm-boards a little bit; correct?  
16:53:40 15 A. Yes.  
16:53:40 16 Q. Okay. And if the flow is not fast enough,  
16:53:44 17 it's going to be -- it's going to start transferring  
16:53:46 18 hot air -- the air below the -- the arm-board is going  
16:53:51 19 to increase over time until it reaches steady state  
16:53:55 20 based on the flow of air escaping and the amount of  
16:53:58 21 heat that's being transferred. Correct?  
16:54:01 22 A. No.  
16:54:01 23 Q. Well --  
16:54:02 24 A. That's not the only explanation.  
16:54:04 25 Q. What's the other explanation?

16:54:06 1 A. What Gary Settles showed --  
16:54:09 2 Well first of all, he said he did not know  
16:54:11 3 whether there is air that actually went beneath the  
16:54:14 4 arm-boards. That's my best reco --  
16:54:16 5 Q. I'm not talking heat --  
16:54:16 6 I'm not talking air, we're talking about  
16:54:18 7 heat.  
16:54:18 8 A. Okay.  
16:54:19 9 Q. Heat.  
16:54:20 10 A. Okay. If temperatures are higher below the  
16:54:23 11 arm-board, if temperature measurements are higher,  
16:54:28 12 what are the possible explanations? One explanation  
16:54:32 13 is what you've just articulated, that hot air may get  
16:54:36 14 below the arm-boards. That's an explanation. Another  
16:54:38 15 explanation is that heat, as you pointed out, and I  
16:54:44 16 neglected this in my model, heat conducts through  
16:54:46 17 solids. Heat would conduct through the arm-board and  
16:54:50 18 that heat would end up on the undersurface of the  
16:54:55 19 arm-board. A third explanation is that he reported he  
16:54:59 20 put the -- a thermocouple or a thermal sensor under  
16:55:04 21 the drape and underneath the arm-board somewhere. If  
16:55:08 22 his thermal sensor was between the drape and the  
16:55:10 23 arm-board, or if it was in visible sight of the drape,  
16:55:13 24 the sensor was warmed by infrared radiation. And  
16:55:17 25 remember, sensors sense the temperature around them,

16:55:20 1 they don't sense their own temperature.

16:55:22 2 So there's other explanations, --

16:55:25 3 Q. Okay.

16:55:26 4 A. -- including the one you've given, about how

16:55:28 5 the undersurface of the arm-board could warm.

16:55:30 6 Q. Okay. And if you gave material properties

16:55:33 7 to the patient, and to the arm-board, and to the

16:55:36 8 drapes, your model would be able to show where the

16:55:40 9 heat is going to; correct?

16:55:43 10 A. My model would be able to show heat

16:55:46 11 conduction through solids, if that's what you mean.

16:55:50 12 Q. And heat conduction through air.

16:55:53 13 A. My model does show heat conduction through

16:55:55 14 air.

16:55:56 15 Q. Okay. Okay. I understand that.

16:55:57 16 But you agree with me --

16:55:59 17 But -- But since you made the board

16:56:02 18 adiabatic, the drape adiabatic, and all the -- and

16:56:05 19 everything in that room adiabatic except for air, we

16:56:09 20 can't see the transfer of heat to the arm-board, to

16:56:15 21 the drapes, and then its effect on the air below the

16:56:18 22 operating room table; correct?

16:56:20 23 A. We cannot see conductive heat transfer.

16:56:22 24 However, you have to recognize that this model was a

16:56:26 25 replication of an actual OR, and in an actual OR what

16:56:30 1 I recall from the setup was there was an arm, there  
16:56:34 2 was a pillow, then there was another arm and the  
16:56:37 3 blanket wrapped around.

16:56:39 4 I made a judgment that the heat would not  
16:56:42 5 transfer through the pillow. I don't know if Gary  
16:56:46 6 Settles had an insulating pillow in his experiment. I  
16:56:50 7 don't know if he provided that detail or perhaps my  
16:56:52 8 memory's faulty.

16:56:53 9 Q. Well you've read his report; correct?

16:56:55 10 A. Yes.

16:56:55 11 Q. And I asked you if his data in his report's  
16:56:58 12 reliable, and you said "yes." And now you're sitting  
16:57:01 13 here telling me that you don't know how he took  
16:57:03 14 temperature measurements?

16:57:03 15 MR. GOSS: Object to form.

16:57:04 16 A. No, that's not what I'm telling you.

16:57:06 17 Q. Well do you know where he took the  
16:57:07 18 temperature measurements? Did he take them between  
16:57:09 19 the arm and the -- and the board -- and the arm-board?

16:57:12 20 MR. GOSS: Lack of foundation. If you have  
16:57:14 21 a --

16:57:15 22 Q. If you don't know, remember you can just say  
16:57:17 23 the words "I don't know."

16:57:18 24 A. What Gar --

16:57:19 25 What I recall Gary Settles saying, Dr.

16:57:22 1 Settles saying, is that the temperature measurement  
16:57:24 2 was made under the drape, so clearly under the drape.  
16:57:28 3 What I recall him saying was that the temperature  
16:57:31 4 underneath the arm-board was warmer.

16:57:34 5 Q. 28 degrees Celsius; correct? At one point.

16:57:38 6 A. I believe that was the maximum.

16:57:40 7 Q. Okay. 26 to 28 degrees Celsius depending on  
16:57:43 8 where he took it; correct?

16:57:44 9 A. That is what I recall.

16:57:45 10 Q. Okay. So --

16:57:45 11 A. What Gary Settles --

16:57:46 12 Q. -- it definitely shows that heat is getting  
16:57:48 13 underneath the arm-board; correct?

16:57:50 14 MR. GOSS: Hold on.

16:57:50 15 A. What Gary Settles was trying to do was to  
16:57:54 16 explore the veracity of Elghobashi's boundary  
16:57:58 17 conditions by looking at temperatures. As I  
16:57:59 18 understand it, and if I'm wrong I'm happy to admit I'm  
16:58:03 19 wrong. As I understand it, he was looking to see if  
16:58:05 20 he could find temperatures of 41 degrees Celsius under  
16:58:09 21 the table as reported by Elghobashi, and that was the  
16:58:12 22 intent of his study. In that respect it is reliable.

16:58:17 23 Q. You agree with me that if you put a heat  
16:58:20 24 source in a room, its change in the temperature in the  
16:58:25 25 room is relative to time; correct?

16:58:29 1 A. Yes.

16:58:29 2 Q. Okay. So if I put a 1600 BTU heater in this

16:58:37 3 corner and turn it on, it might take time until you

16:58:40 4 feel its effects where you're sitting in the

16:58:42 5 deposition chair; correct?

16:58:44 6 A. I agree.

16:58:44 7 Q. Okay. So time is definitely a factor with

16:58:49 8 respect to heat flow.

16:58:51 9 A. It can be.

16:58:52 10 Q. Okay. Well again, with heat flow it would

16:58:56 11 take time for this room with a 1600 BTU heater,

16:59:01 12 powered heater, to come to a steady state in this

16:59:03 13 room; correct?

16:59:04 14 A. I agree.

16:59:06 15 Q. Okay. And you agree with me that when you

16:59:08 16 turn the Bair Hugger on it's going to take some time

16:59:12 17 for the area -- if the area under the floor board is

16:59:17 18 heated, to reach steady state; correct?

16:59:18 19 MR. GOSS: "Under the floor board"?

16:59:20 20 MR. ASSAAD: Or under the arm-board.

16:59:21 21 A. I would agree.

16:59:23 22 Q. Okay. And depending on when you take that

16:59:26 23 measurement, unless you're absolutely certain you're

16:59:30 24 at steady state it might not be the max temperature

16:59:33 25 underneath the arm-board; correct?

16:59:35 1 A. Correct.

16:59:35 2 Q. Okay. And do you recall his deposition in

16:59:39 3 which he could not identify any of the times that he

16:59:42 4 took the temperature measurements?

16:59:44 5 MR. GOSS: Object to form, lack of

16:59:46 6 foundation. If you remember from reading the

16:59:49 7 transcript, you can indicate as much.

16:59:51 8 A. I don't recall that.

16:59:52 9 Q. Okay. And the fact that --

17:00:20 10 MR. ASSAAD: Let's turn this upside down so

17:00:22 11 I can see looking straight down.

17:00:22 12 (Image manipulated.)

17:00:25 13 MR. ASSAAD: Okay. Right there is perfect.

17:00:27 14 Q. You agree with me that there is an opening

17:00:29 15 to the arm-board in your model right underneath right

17:00:32 16 here; correct?

17:00:33 17 MR. GOSS: Can you tell me what we're

17:00:35 18 looking at right now? I'm sorry.

17:00:35 19 Q. Do you know what we're looking at, Dr.

17:00:39 20 Abraham?

17:00:39 21 A. It's hard for me to see from this side of

17:00:40 22 the room.

17:00:42 23 Q. All right. Feel free to get closer.

17:00:43 24 MR. GOSS: I don't -- I can't tell how you

17:00:45 25 oriented it. I could understand what we were looking

17:00:48 1 at and then you tilted it, and now are we looking at  
17:00:51 2 from the ceiling down?

17:00:52 3 MR. ASSAAD: From the floor up.

17:00:53 4 MR. GOSS: From the floor up. Thank you.

17:00:55 5 MR. ASSAAD: And you could notice by the  
17:00:56 6 X/Y coordinates here.

17:00:58 7 MR. GOSS: If I knew anything about that I  
17:00:59 8 could, that's true.

17:01:00 9 Q. You agree with me you're looking from the  
17:01:02 10 floor up; correct?

17:01:03 11 A. I agree.

17:01:04 12 MR. GOSS: Thank you.

17:01:06 13 Q. Okay. And if you are looking from the floor  
17:01:09 14 up, you see that there's a pathway to that arm-board  
17:01:13 15 that's in that little area here. Do you agree?

17:01:17 16 A. Could you color the body so that I can --  
17:01:20 17 Everything is blue now and I can't distinguish between  
17:01:24 18 different features.

17:01:27 19 Okay. So we're not looking at the body.

17:01:30 20 Q. I said the arm-board.

17:01:34 21 MR. ASSAAD: Can you get a better view of  
17:01:39 22 the... .

17:01:45 23 (Image manipulated.)

17:01:45 24 BY MR. ASSAAD:

17:01:45 25 Q. I mean, based on the geometry do you agree

17:01:47 1 that that's the arm-board?

17:01:49 2 A. I would agree.

17:01:50 3 Q. Okay. And you agree with me that it looks

17:01:52 4 like you could see into where the drape is there's an

17:01:55 5 open area there; correct?

17:01:57 6 A. We can visually see that on the screen.

17:01:59 7 Q. Okay.

17:02:00 8 A. But it's not necessary that there's a flow

17:02:02 9 path.

17:02:03 10 Q. Well the reason why there's --

17:02:05 11 You can sit down.

17:02:06 12 The reason why --

17:02:07 13 MR. ASSAAD: Let's go back to the boundary

17:02:12 14 condition.

17:02:14 15 (Discussion off the stenographic record.)

17:02:20 16 (Image manipulated.)

17:02:20 17 Q. You agree with me that --

17:02:22 18 MR. ASSAAD: A little more to the right so

17:02:24 19 I can see some red. To the right. Other way. Okay.

20 (Image manipulated.)

17:02:28 21 Q. You agree with me that the boundary

17:02:31 22 condition set for the Bair Hugger inlet is for a mass

17:02:36 23 flow of heat going out of the inlet, correct,

17:02:41 24 perpendicular?

17:02:44 25 A. A mass flow --

17:02:45 1 There's no such thing as a mass flow of  
17:02:47 2 heat.

17:02:47 3 Q. Well there's a mass flow of air; correct?

17:02:50 4 A. Correct.

17:02:50 5 Q. And there's heat --

17:02:51 6 And that air's heated to 41 degrees Celsius;

17:02:53 7 correct?

17:02:54 8 A. Correct.

17:02:54 9 Q. And it's coming out perpendicular to that

17:02:56 10 boundary; correct?

17:02:59 11 A. I don't recall if I set the velocity to be

17:03:02 12 perpendicular, but I would agree it comes out of the

17:03:04 13 boundary.

17:03:05 14 Q. Okay. It comes out of the boundary.

17:03:07 15 There is no -- There's nothing in your model

17:03:10 16 of hot air around the arms; correct?

17:03:14 17 A. Correct.

17:03:15 18 Q. There's no flow of hot air on the arms;

17:03:17 19 correct?

17:03:18 20 A. I did not model the flow of the jets hitting

17:03:21 21 the arm, that is correct.

17:03:22 22 Q. You agree with me that if you did model

17:03:24 23 that, of hot air around the arms, that when we looked

17:03:28 24 at the underside, the view going from the floor to the

17:03:30 25 ceiling, that you'd see a change of temperature in

17:03:32 1 that area.

17:03:33 2 A. Not necessary.

17:03:34 3 Q. Not necessarily? Okay.

17:03:36 4 MR. GOSS: Well wait. Did you say "not

17:03:37 5 necessarily" or "not necessary"?

17:03:39 6 THE WITNESS: Not necessarily.

17:03:40 7 MR. GOSS: Okay. Thanks.

17:03:43 8 Q. So you're telling me if I have hot air

17:03:45 9 blowing at 41 degrees Celsius on my hand, okay, and

17:03:50 10 I'm looking at it and it's coming --

17:03:52 11 Air is fluid; correct?

17:03:54 12 A. Air is a fluid.

17:03:55 13 Q. -- and if I'm looking at it from the bottom

17:03:57 14 I'm not going to see a change in temperature in this

17:04:00 15 area [indicating]?

17:04:01 16 A. That's not what I'm saying.

17:04:02 17 Q. What are you saying, then?

17:04:05 18 A. Remember -- and I believe this is true with

17:04:06 19 Dr. Elghobashi's model as well -- I did not model the

17:04:10 20 solids, which means if you look up from the bottom

17:04:15 21 you're not going to see the temperature of the air.

17:04:20 22 So I am not saying -- I will agree with you

17:04:23 23 that if I modeled the air jets impinging on the skin,

17:04:27 24 if I modeled that air region you would see it.

17:04:30 25 Q. But you did model the air; correct?

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17:04:33 1 A. Yes.

17:04:34 2 Q. Well there's air around the board; correct?

17:04:37 3 A. There is air in the blanket, and between the

17:04:40 4 blanket and the skin.

17:04:42 5 Q. Okay. And some of the air goes around the

17:04:47 6 board; correct?

17:04:50 7 A. I disagree.

17:04:51 8 Q. You disagree. Okay.

17:04:54 9 Is there any basis, scientific basis why you

17:04:56 10 disagree except that based on your experience --

11 A. Yes.

17:05:00 12 Q. -- with forced-air warming blankets?

17:05:01 13 A. Yes.

17:05:02 14 Q. What's your basis?

17:05:06 15 A. I'll try to do a better job of explaining

17:05:08 16 it, because I think it's -- multiple times. I'm going

17:05:11 17 to use my arm and --

18 THE WITNESS: If you can't catch this on

17:05:14 19 the screen, I apologize.

17:05:17 20 A. The way the person is sitting they're laying

17:05:19 21 like this. [Demonstrating.]

17:05:20 22 Q. Is that how he's laying?

17:05:21 23 A. Well it's essentially this. They've got two

17:05:24 24 arms out to the side and is --

17:05:25 25 Q. Is there anything between the arms?

17:05:26 1 A. As I recall, there's a pillow.

17:05:28 2 Q. Okay.

17:05:28 3 A. Okay. There are blank --

17:05:30 4 There is a hot warming blanket which wraps

17:05:34 5 around the arm, and in fact I think a cartoon version

17:05:39 6 of this was provided in Said Elghobashi's, maybe it

17:05:44 7 was his supplemental report or something that I saw

17:05:47 8 yesterday where he had these tubes around the arm.

17:05:49 9 Okay? And that's -- that cartoon outlines this quite

17:05:53 10 well, okay? So you have these tubes around the arm.

17:05:56 11 The tubes have these little jets of air that are one

17:06:00 12 millimeter in diameter, approximately. They hit the

17:06:03 13 skin, they stop. We call that stagnation. So now you

17:06:08 14 have a warm stagnant body of air.

17:06:11 15 Now the question is, where does it go? If I

17:06:15 16 have warm air near my hands, is that warm air going to

17:06:19 17 travel up my arms and then out the open space by my

17:06:23 18 head? And mind you there is air jets all along the

17:06:28 19 way. So there's some air being -- hitting the arm

17:06:30 20 here, and stagnating. There's other air hitting the

17:06:34 21 arm here. There's other air hitting the arm here. A

17:06:37 22 tiny amount is at the hands, but there's air all the

17:06:41 23 way along, and in fact in the center part of the --

17:06:43 24 the blanket. So you have air oozing out of this

17:06:46 25 blanket very slowly, it hits the arms, it's stagnant.

17:06:49        1 Then what does it do? If you're hot air right here  
17:06:54        2 are you going to be able to go down to the bottom of  
17:06:59        3 the drapes and then emerge out into the room? That's  
17:07:02        4 possible. Or are you going to just migrate upwards  
17:07:05        5 along with buoyant forces? That is actually what  
17:07:08        6 happens. There is no physical mechanism that would  
17:07:12        7 force that stagnant warm air to go downwards to the  
17:07:18        8 floor and then come back up. It's the analogy that I  
17:07:21        9 used before; the match, or incense, or a cigarette.  
17:07:26        10 If you hold those things upside down, the smoke or the  
17:07:29        11 flame still rise.

17:07:34        12 Q. Are you done?

17:07:34        13 A. Yes.

17:07:35        14 Q. Okay. Let's talk about heat, though. Are  
17:07:39        15 you saying all the heat's going to go out the head and  
17:07:41        16 neck?

17:07:43        17 A. In my model all the hot air emerged by the  
17:07:47        18 head and neck. I did not allow heat to transfer by  
17:07:51        19 conduction, for example, through the arm-board.

17:07:54        20 Q. Okay. And we know through Settles' results  
17:07:58        21 that heat does travel by conduction and heats up the  
17:08:02        22 -- the -- underneath the operating room table.

17:08:05        23 A. We do --

17:08:05        24 MR. GOSS: Object to form.

17:08:05        25 A. -- not know that.

17:08:06 1 Q. Okay. So you disagree with Settles.

17:08:12 2 A. No.

17:08:12 3 Q. Okay.

17:08:13 4 A. I gave two explanations of how temperature

17:08:15 5 measurements in the place he made them could be

17:08:16 6 elevated, not -- one of them was not by conduction.

17:08:21 7 Q. Okay. But regardless of what method it was

17:08:23 8 heated, it was done by the Bair Hugger.

17:08:28 9 A. I would agree.

17:08:30 10 MR. GOSS: Lack of foundation. You can

17:08:30 11 answer if you know.

17:08:31 12 A. I would agree.

17:08:33 13 Q. I mean, conservation of energy, you need a

17:08:36 14 heat source to increase temperature; correct?

17:08:39 15 A. I agree.

17:08:39 16 Q. Okay.

17:08:42 17 MR. GOSS: I'm sorry, Gabriel, can I take a

17:08:44 18 bathroom break when you have a chance? Too much

17:08:48 19 coffee.

17:08:51 20 MR. ASSAAD: If I said "no," would you be

17:08:53 21 upset?

17:08:54 22 MR. GOSS: I'd be uncomfortable.

17:08:55 23 MR. ASSAAD: You can take a break.

17:08:58 24 MR. GOSS: Thanks.

17:08:59 25 MR. ASSAAD: Off the record.

17:08:59 1 THE REPORTER: Off the record, please.

17:09:01 2 (Recess taken from 5:09 to 5:16 p.m.)

17:16:12 3 BY MR. ASSAAD:

17:16:16 4 Q. So real quick a couple of things. Looking

17:16:19 5 at that picture up there if you look on the left side

17:16:22 6 it says -- it states, time, 1.2 seconds. Would you

17:16:30 7 agree with me that the file that you provided to us

17:16:35 8 was at a simulation time of 1.2 seconds?

17:16:38 9 A. No. I don't know if it was. That looks to

17:16:41 10 be an expression that was made, and I can't recall if

17:16:43 11 I made a time expression. Oh, I'm sorry. I thought

17:16:47 12 you were looking at the bottom.

17:16:48 13 Q. No. The right -- left-hand side --

17:16:50 14 A. Yes.

17:16:50 15 Q. -- where it says "time."

17:16:51 16 A. I agree.

17:16:52 17 Q. Okay. So your model is basically a

17:16:54 18 simulation of 1.2 seconds; correct?

17:16:54 19 MR. GOSS: Object to form.

17:16:57 20 A. The results shown here --

17:16:58 21 Q. Yes.

17:17:00 22 A. -- are the results after 1.2 seconds.

17:17:02 23 Q. Of simulation time.

17:17:03 24 A. Correct.

17:17:03 25 Q. Okay. Which is 1.2 seconds real time;

17:17:06 1 correct?

17:17:06 2 A. Correct.

17:17:07 3 Q. And as I understand it, the streamlines is a

17:17:11 4 line based on the instantaneous velocity at a

17:17:14 5 particular cell; correct?

17:17:18 6 A. Yes.

17:17:18 7 Q. Okay. It's not that you're following the

17:17:22 8 air around the operating room and seeing where that

17:17:29 9 particular air goes; correct?

17:17:33 10 A. It is an instant --

17:17:34 11 What the streamline is is an instantaneous

17:17:34 12 --

17:17:39 13 Let me tell you how streamlines are made.

17:17:42 14 The vectors which describe the flow direction and

17:17:46 15 speed are all obtained at a time instant and then they

17:17:50 16 are connected by their tangents, and that gives us

17:17:53 17 streamlines. So it's an instantaneous trajectory of

17:17:56 18 air.

17:17:57 19 Q. So one of the videos I believe lasted about

17:17:59 20 three minutes, or three and a half minutes long that

17:18:01 21 you provided in this case; correct?

17:18:03 22 A. I don't know that.

17:18:05 23 Q. Okay. Well the video is on YouTube. You've

17:18:07 24 seen your videos on YouTube that 3M has put on with

17:18:10 25 respect to your -- this CFD analysis.

17:18:12 1 A. I have seen the CFD analysis on YouTube.

17:18:15 2 Q. And you've created the YouTube videos which

17:18:17 3 are about -- more than 1.2 seconds long; correct?

17:18:21 4 A. Correct.

17:18:23 5 Q. Okay. The fact that the video is -- say,

17:18:26 6 for example, is three minutes long of streamlines, or

17:18:29 7 two minutes, doesn't mean that you ran the model for

17:18:32 8 two minutes; correct?

17:18:34 9 A. That is correct.

17:18:34 10 Q. Okay. And so it's your opinion today that

17:18:40 11 you got quasi-steady state by running the model in 1.2

17:18:45 12 seconds.

17:18:46 13 A. Yes.

17:18:47 14 Q. Okay. Is it possible to run the model

17:19:05 15 forward based on the TRN file?

17:19:07 16 A. Yes.

17:19:07 17 Q. Without the initial conditions?

17:19:09 18 A. Correct.

17:19:18 19 Q. Now the fact that this is the 264th time

17:19:25 20 step, does that indicate to you what your time step

17:19:27 21 was?

17:19:31 22 A. No. I don't -- Looking at this here, I

17:19:36 23 don't see -- it doesn't tell me the time step and I

17:19:38 24 don't recall, sitting here.

17:19:40 25 Q. Can you determine the time step by looking

17:19:42 1 at the ANSYS file?

17:19:47 2 A. Could you determine it? Yes, you could.

17:19:50 3 Q. How would you do that?

17:19:52 4 A. Well remember this file, the TRN file

17:19:55 5 contains everything, in the sense that it contains the

17:19:58 6 mesh, the geometry and the setup. So you could pull

17:20:01 7 it into the setup.

17:20:02 8 Q. So if I told you you could take over this

17:20:04 9 ANSYS program right now and determine the time step,

17:20:06 10 that's something you could do?

17:20:08 11 A. I may be able to.

17:20:09 12 Q. How long would it take you?

17:20:13 13 A. Boy, I don't know how long it would take me.

17:20:17 14 Q. Well where would you look?

17:20:21 15 A. I would load this thing into the CFX, what's

17:20:25 16 called the setup file, and I would look there.

17:20:28 17 Q. Okay. You used ANSYS Academic; correct?

17:20:43 18 A. Incorrect.

17:20:44 19 Q. "Incorrect"?

17:20:44 20 A. Incorrect.

17:20:46 21 Q. What did you use?

17:20:47 22 A. ANSYS Research.

17:20:48 23 Q. That's part of the Academics soft --

17:20:51 24 package; correct?

17:20:55 25 A. I recall them being separate. I mean, if

17:20:58       1   you show me documentation that they are part of a  
17:21:00       2   single suite, then I would defer. But I recall ANSYS  
17:21:05       3   Academic and Research as separate licenses and  
17:21:11       4   separate software capabilities.

17:21:59       5   Q.   So to determine the time step you would load  
17:22:01       6   the TRN file into a CF -- CFX file --

17:22:03       7   A.   Correct.

17:22:06       8   Q.   -- to the CFX setup program?

17:22:07       9   A.   Yes.

17:22:08       10   Q.   Okay. Now in some of your images it shows  
17:22:15       11   "ANSYS 17.1 Academic," not on here but on the files  
17:22:20       12   that you sent. Does that sound familiar?

17:22:22       13   A.   No. I don't recall that.

17:22:32       14   Q.   I'm going to show you on my computer, and we  
17:22:35       15   could -- I'm just going to show it to you. This is  
17:22:37       16   what's been provided to me, and it says "ANSYS R17.1  
17:22:42       17   Academic;" is that correct? [Showing computer screen  
17:22:42       18   to witness.]

17:22:43       19   A.   Yes.

17:22:44       20   Q.   Okay. Does that mean Academic that was  
17:22:48       21   used?

17:22:50       22   A.   Well it's my understanding, looking at that,  
17:22:53       23   that it's the Research license that's -- I believe  
17:22:56       24   that's what the "R" stands for, and as you pointed out  
17:23:01       25   earlier, that may be part of the Academic suite, and

17:23:03        1    so I would concur. It appears as though it's the  
17:23:07        2    Research portion of the Academic license.

17:23:09        3    Q.    And you agree with me that the ANSYS  
17:23:12        4    Research license is not allowed to be used for  
17:23:15        5    consulting; correct?

17:23:18        6    A.    I believe that is true.

17:23:19        7    Q.    Okay. And you actually use it for  
17:23:22        8    consulting; correct?

17:23:23        9    A.    I disagree.

17:23:24        10   Q.    So the fact that 3M was in litigation and  
17:23:26        11   hired you as an expert to do the CFD study, you don't  
17:23:32        12   -- that wasn't in your -- in a consulting role to 3M?

17:23:36        13   A.    I was hired in an academic capacity to do  
17:23:40        14   the CFD.

17:23:41        15   Q.    You were hired by Lori Cohen and Greenberg  
17:23:44        16   Trauring; correct?

17:23:45        17   MR. GOSS: Object to form.

17:23:46        18   A.    I don't know who officially hired.

17:23:49        19   Q.    Okay.

17:23:51        20   A.    But my understanding is I was hired to do an  
17:23:55        21   academic study, which is totally appropriate using the  
17:23:59        22   Research license that I used. The expert witness work  
17:24:03        23   is a separate issue, separate payment, and there's no  
17:24:05        24   formal proposal.

17:24:05        25   Q.    Okay. You were hired by the attorneys of

17:24:07 1 Greenberg Traurig to do your CFD; correct?

17:24:10 2 A. I don't know that.

17:24:10 3 Q. Who contacted you first?

17:24:12 4 A. I don't recall.

17:24:13 5 Q. Okay. But you have no disagreement that --

17:24:25 6 that ANSYS Research is not allowed to be used for

17:24:28 7 consulting purposes.

17:24:30 8 A. I don't believe it is allowed to be used for

17:24:32 9 consulting purposes.

17:25:18 10 Q. You understand that you were contacted in

17:25:20 11 this case to do research with respect to a litigation

17:25:24 12 that was ongoing in 2015.

17:25:27 13 MR. GOSS: Object to form, mischaracterizes

17:25:29 14 his testimony.

17:25:31 15 A. I understand that I was contacted to

17:25:35 16 determine whether a device like the Bair Hugger would

17:25:38 17 interrupt operating-room airflow. I did understand

17:25:41 18 that it was part of a litigation.

17:25:43 19 Q. And in fact when you got -- you did your

17:25:46 20 experimental measures at -- at the OR, there were

17:25:49 21 lawyers there; correct?

17:25:51 22 A. That is correct.

17:25:51 23 Q. Okay. Are you aware of law firms contacting

17:25:57 24 universities to do research?

17:25:59 25 MR. GOSS: Just going to object to what

17:26:02 1 this may -- I don't see what this has to do with his  
17:26:05 2 scientific opinions in this case, --  
17:26:07 3 MR. ASSAAD: Well it goes to his --  
17:26:08 4 MR. GOSS: -- but if you can answer the  
17:26:09 5 question, then you may.  
17:26:13 6 A. My understanding is 3M wanted to understand  
17:26:18 7 the airflow in an operating room, and that's an  
17:26:21 8 academic question with real academic significance.  
17:26:27 9 That study was performed as we normally perform  
17:26:30 10 studies where a fixed-cost grant proposal was given.  
17:26:34 11 That study was the basis for the computational fluid  
17:26:38 12 dynamics and for the journal paper publication.  
17:26:40 13 Q. And all the consulting fees you were  
17:26:44 14 receiving on behalf -- from 3M directly is from you  
17:26:51 15 offering opinions based on that study done at St.  
17:26:55 16 Thomas; correct?  
17:26:58 17 A. No.  
17:26:59 18 Q. Well all that we discussed about today and  
17:27:03 19 all your opinions in this case is -- is with respect  
17:27:07 20 to your CFD analysis of the problem.  
17:27:11 21 A. That is incorrect.  
17:27:14 22 Q. Okay. What else?  
17:27:17 23 A. For example, I read a lot of literature, I  
17:27:22 24 read depositions, I read expert reports, I performed  
17:27:31 25 experiments. So to say that all of my opinions -- I

17:27:37 1 -- To say, for example, my opinions about Said  
17:27:40 2 Elghobashi's work, that was not based on my CFD, so --  
17:27:42 3 so it's incorrect to say that all of my opinions are  
17:27:44 4 based on the CFD.

17:27:46 5 Q. Many of your opinions are based on the CFD  
17:27:48 6 that you've given today; correct?

17:27:49 7 A. Some of my opinions are based on the CFD  
17:27:51 8 work that we have discussed today.

17:27:53 9 Q. Well we've barely -- we rarely talked about  
17:27:57 10 Elghobashi's report so far; correct?

17:27:59 11 A. That is correct.

17:27:59 12 Q. Okay. And you're using the results of your  
17:28:27 13 CFD analysis in formulating your opinions regarding --  
17:28:36 14 some of your opinions in this case; correct?

17:28:38 15 A. I agree.

17:28:38 16 Q. Okay. And in fact you plan on testifying in  
17:28:41 17 trial regarding the CFD analysis you performed in this  
17:28:44 18 case; correct?

17:28:48 19 A. I am prepared to testify in trial based on  
17:28:52 20 these CFD results.

17:28:53 21 Q. And that's not research, that's consulting;  
17:28:54 22 correct?

17:28:56 23 A. Well that would be unpaid consulting, but  
17:28:58 24 yes.

17:28:58 25 Q. Okay. Because you're not getting paid for

17:29:01 1 trial testimony; correct?

17:29:02 2 A. Correct.

17:29:18 3 Q. Now --

17:29:18 4 MR. ASSAAD: Let's mark this.

17:29:29 5 (Abraham Exhibit 9 marked for

6 identification.)

7 BY MR. ASSAAD:

17:29:30 8 Q. Exhibit 9 is a document titled -- with the

17:29:34 9 Bates number Wagner 0000013. Have you received this

17:29:38 10 document before?

17:29:49 11 A. Yes.

17:29:50 12 Q. Okay. And this was authored by Andrew Chen,

17:29:54 13 correct? If you look at the bottom left-hand corner?

17:29:58 14 A. Yes.

17:29:59 15 Q. Okay. And is this the document where -- in

17:30:02 16 which you obtained your initial boundary conditions

17:30:08 17 with respect to mass flow?

17:30:10 18 A. "Initial" and "boundary conditions" don't go

17:30:12 19 together.

17:30:12 20 Q. I'm sorry. Your boundary conditions.

17:30:14 21 A. This is the document which confirmed my

17:30:16 22 understanding of the boundary condition for the Bair

17:30:18 23 Hugger. So I would say it confirmed my boundary

17:30:21 24 conditions.

17:30:22 25 Q. Okay. And if you look at pages 23, 24, 25

17:30:42 1 and 26, and 27 and 28, those are the diagrams and

17:30:47 2 pictures of the OR that's represented in your CFD

17:30:49 3 model; correct?

17:30:58 4 A. I believe that's true.

17:30:59 5 Q. Okay. And the geometry which is on page

17:31:03 6 Wagner 28 is the geometry that was most likely

17:31:07 7 provided to you by 3M; correct?

17:31:18 8 MR. GOSS: Lack of foundation, but you can

17:31:19 9 answer if you know.

17:31:21 10 A. I don't know if that is the geometry.

17:31:23 11 Q. Okay. But it's very similar; correct?

17:31:31 12 A. (Witness reviewing exhibit.)

17:31:35 13 MR. GOSS: You're on page 28?

17:31:37 14 MR. ASSAAD: Yes.

17:31:37 15 A. Yeah, it is --

17:31:39 16 Yes. I would agree.

17:31:41 17 Q. Okay. And in fact the -- Never mind.

17:31:55 18 Do you agree that it seems like a study was

17:31:58 19 done by 3M that was memorialized in this memo on

17:32:01 20 October 15, 2015?

17:32:06 21 A. Yes.

17:32:07 22 Q. Okay. And they did schlieren testing at 3M.

17:32:16 23 MR. GOSS: Wait for a question.

17:32:18 24 Q. Correct?

17:32:19 25 MR. GOSS: Objection, lack of foundation.

17:32:25 1 MR. ASSAAD: I'll withdraw that ques --  
17:32:26 2 Q. Do you agree that this model contains  
17:32:28 3 schlieren photography?  
17:32:30 4 MR. GOSS: The memo.  
17:32:30 5 MR. ASSAAD: Yes.  
17:32:31 6 MR. GOSS: You said "model."  
17:32:32 7 MR. ASSAAD: Huh?  
17:32:33 8 MR. GOSS: Sorry. You said "model." You  
17:32:35 9 meant "memo."  
17:32:36 10 A. Yes.  
17:32:37 11 Q. Okay. And if you look at page Wagner 19,  
17:32:51 12 you agree with me that the bottom image shows a  
17:32:54 13 schlieren photography of air from a rolled-up Bair  
17:33:01 14 Hugger blanket; correct? Figure 8.  
17:33:09 15 (Interruption by the reporter.)  
17:33:10 16 A. What's your question again?  
17:33:18 17 Q. According to Figure 8 it's a schlieren  
17:33:21 18 picture of air emitted from the end of a rolled-up  
17:33:23 19 Bair Hugger blanket; correct?  
17:33:28 20 A. That's what this figure shows.  
17:33:30 21 Q. Okay. And you have no reason to disagree  
17:33:31 22 with that; correct?  
17:33:33 23 A. Correct.  
17:33:34 24 Q. Okay. And in fact the schlieren mirror is  
17:33:38 25 26 inches in length; correct?

17:33:42 1 MR. GOSS: Object to the lack of  
17:33:45 2 foundation. If that's what the document shows, you  
17:33:47 3 can testify to that.  
17:33:48 4 A. 26 inches is stated in the document.  
17:33:51 5 Q. Okay. Let's look at Figure 9 on the  
17:33:57 6 following page, Wagner 20. Figure 9 says, "Air  
17:34:02 7 departing the region around the blanket representing  
17:34:04 8 the neck region of the blanket." Do you see that?  
17:34:07 9 A. Yes.  
17:34:08 10 Q. And you see a schlieren photography and  
17:34:11 11 something there that says 6 inches; correct?  
17:34:16 12 A. Yes.  
17:34:17 13 Q. Okay. So you would agree with me that the  
17:34:21 14 -- the disruption or the -- the refractiveness of the  
17:34:29 15 -- the light or the imaging, which is what schlieren  
17:34:32 16 shows --  
17:34:33 17 You understand that; correct?  
17:34:34 18 A. Yes.  
17:34:34 19 Q. -- is when the air is coming out of the neck  
17:34:36 20 region of the blanket it's a little over 6 inches;  
17:34:39 21 correct?  
17:34:40 22 MR. GOSS: Object to the lack of  
17:34:41 23 foundation, lack of expertise in schlieren imaging.  
17:34:44 24 You can testify to what the document shows if you  
17:34:46 25 understand it.

17:34:48 1 A. Can you restate your question?

17:34:50 2 Q. Let me ask. Do you --

17:34:51 3 Have you ever used schlieren photography

17:34:53 4 before?

17:34:53 5 A. No.

17:34:54 6 Q. Okay. Do you understand schlieren

17:34:55 7 photography?

17:34:56 8 A. I understand the basics of it.

17:34:59 9 Q. Okay. So the fact that if you look at the

17:35:03 10 -- the -- Strike that.

17:35:08 11 Now with respect to -- Let's go to page 15.

17:35:51 12 Figure 2 says a "System of Bair Hugger Model 750

17:35:54 13 blower and Upper Body Model 522 blanket integrated

17:35:59 14 with flow measurement system pitot tube in a flow

17:36:05 15 development pipe and" --

17:36:05 16 (Interruption by the reporter.)

17:36:05 17 Q. -- with flow measurement system pitot tube,

17:36:08 18 P-I-T-O-T, in a flow development pipe and "Magnehelic

17:36:14 19 manometer."

17:36:14 20 A. It's "Magnehelic," but yes.

17:36:17 21 Q. Okay. And in fact if you look, you agree

17:36:22 22 with me that 3M did testing to determine the initial

17:36:29 23 conditions to be used in a CFD analysis.

17:36:33 24 A. I'm not clear in this document where it says

17:36:35 25 that.

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17:36:36 1 Q. Okay. If you look at page Wagner 14, under  
17:36:49 2 **"Bair Hugger Product Testing"** it states: Testing the  
17:36:53 3 Bair Hugger product for volumetric flow was necessary  
17:36:57 4 to determine the boundary condition for a CFD model of  
17:37:00 5 a blanket with an actual operating room.  
17:37:03 6 Did I read that correctly?  
17:37:04 7 A. Yes.  
17:37:04 8 Q. So you agree with me that they did product  
17:37:06 9 testing to determine the -- a boundary condition for  
17:37:10 10 the -- for a CFD model; correct?  
17:37:13 11 A. Yes.  
17:37:14 12 Q. And it says: A mass flowrate inlet  
17:37:16 13 condition was used in the operating room CFD model as  
17:37:18 14 the operating room supply air inlet boundary condition  
17:37:22 15 as well as the Bair Hugger air inlet using faces at  
17:37:25 16 the inlet boundary.  
17:37:27 17 Did I read that correctly?  
17:37:28 18 A. With the exception of you said "at," I  
17:37:31 19 think, or -- yeah -- yes, you read that correctly.  
17:37:35 20 MR. GOSS: I'm just going to insert an  
17:37:36 21 objection that 3M may have done some testing  
17:37:39 22 internally for attorney-client purposes, we would  
17:37:44 23 assert work-product protection over that and reserve  
17:37:47 24 the right to claw back any portions of this memo that  
17:37:50 25 relate to that and do not have any relevance to Dr.

17:37:56 1 Abraham's work or his use of the document.

17:38:00 2 MR. ASSAAD: Okay.

17:38:01 3 Q. So it states here under the last paragraph:

17:38:03 4 "For the Upper Body (Model 522) with one side rolled

17:38:07 5 up," -- And that's the case that you used in your CFD

17:38:10 6 modeling; correct?

17:38:11 7 A. Correct.

17:38:12 8 Q. Okay.

17:38:12 9 -- "a mass flow rate of 0.237 kilograms per

17:38:17 10 second was calculated and used as an inlet condition

17:38:20 11 for the area around the arms in the OR CFD model."

17:38:24 12 Did I read that correctly?

17:38:26 13 A. Yes.

17:38:26 14 Q. You did not have an inlet condition around

17:38:29 15 the arms of an OR CFD model; correct?

17:38:31 16 A. Correct.

17:38:32 17 Q. Okay. For a fully open blanket and draping

17:38:35 18 arrangement, 0.0255 kilograms per second, open

17:38:41 19 parentheses, half on arms and half on the other side

17:38:44 20 of the -- of head, closed parentheses, was used in the

17:38:47 21 second OR CFD model as a Bair Hugger inlet condition.

17:38:51 22 Did I read that correctly?

17:38:52 23 A. Yes.

17:38:53 24 Q. So according to what 3M did, it's my

17:38:56 25 understanding that based on the Bair Hugger product

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17:38:59 1 testing that when the Bair Hugger is folded over, the  
17:39:03 2 mass flow rate of .0237 kilograms per second was going  
17:39:08 3 over the arms; correct?  
17:39:09 4 MR. GOSS: I will object again that any  
17:39:12 5 internal testing --  
17:39:13 6 MR. ASSAAD: I got your objection.  
17:39:14 7 MR. GOSS: -- described in this document --  
17:39:15 8 MR. ASSAAD: Don't waste my time, please.  
17:39:17 9 Stop the clock, then. I don't want to waste my time.  
17:39:17 10 I got your objection, it's already been said, we  
17:39:20 11 don't need to reiterate the record.  
17:39:21 12 MR. GOSS: And this witness has no  
17:39:23 13 foundation. I think he's already said he has no  
17:39:26 14 foundation with respect to any internal CFD testing  
17:39:28 15 that 3M did.  
17:39:31 16 Q. Go on.  
17:39:31 17 Did I read that correctly?  
17:39:33 18 A. I don't recall what you read, actually.  
17:39:35 19 Q. The question was: Do you agree with me that  
17:39:36 20 according to what 3M's product testing did, when the  
17:39:40 21 Bair Hugger blanket is folded over, similar to what  
17:39:43 22 you did in your CFD, that they calculated that there  
17:39:46 23 is a mass flow over -- or on the area around the arms  
17:39:53 24 and that was used in the OR CFD model; correct?  
17:39:57 25 A. That is what it says.

17:39:57 1 MR. GOSS: Same objection.

17:39:59 2 Q. Okay. And when the blanket was open, that

17:40:03 3 based on testing they calculated a mass flow of .0255

17:40:09 4 kilograms per second, which was half on the arms and

17:40:12 5 half on the other side of the head; correct?

17:40:23 6 A. That's what the document says.

17:40:24 7 Q. And in fact you used this document, sir, if

17:40:29 8 you look at page 5 of your report where you took the

17:40:32 9 measurements from this document and applied it in your

17:40:36 10 report. Right above where it says "**Step 5.**"

17:40:47 11 MR. GOSS: You can --

17:40:47 12 Q. I'll read it to you. Page 5, above where it

17:40:51 13 says "Step 5 of the Analysis..." "Measurements were

17:40:53 14 made using a Bair Hugger Blower model 750 and an Upper

17:40:58 15 Body Blanket Model 522 to determine the flowrate

17:41:00 16 through the system. The experiments" -- I'd like to

17:41:03 17 say that word again, "experiments" --

17:41:05 18 MR. GOSS: Okay.

17:41:09 19 Q. -- "found a flow rate" --

17:41:06 20 MR. GOSS: You don't have to make faces at

17:41:08 21 me, Gabriel.

17:41:09 22 Q. -- of .023 kilograms per second for a

17:41:12 23 partially obstructed blanket and .025 kilograms per

17:41:16 24 second for a fully open blanket."

17:41:18 25 Is that correct?

17:41:19 1 A. Correct.

17:41:19 2 Q. And you're basing it off the experiments

17:41:22 3 that 3M did which is marked as Exhibit Number 9;

17:41:25 4 correct?

17:41:25 5 MR. GOSS: Object to form, mischaracterizes

17:41:27 6 his testimony. He has already answered this.

17:41:28 7 If you have a different answer, you may

17:41:30 8 offer it.

17:41:32 9 A. My flow rate was based on my own experience

17:41:35 10 of years working with these types of blankets. As --

17:41:38 11 As I said earlier -- As I said earlier in this

17:41:42 12 deposition, this -- these results confirmed my

17:41:47 13 knowledge of the airflow.

17:41:48 14 Q. I mean, we're talking about a flow rate

17:41:50 15 going out to three decimal places. Correct? Am I

17:41:55 16 correct? Three decimal places; correct?

17:41:59 17 A. Two significant figures.

17:42:00 18 Q. Okay. But three decimal places; correct?

17:42:02 19 "Two significant figures." You want to use two --

17:42:03 20 That's fine.

17:42:04 21 Two significant figures of a difference of

17:42:06 22 .002; correct?

17:42:09 23 A. Are you talking about the 3M document or my

17:42:11 24 document? Because the 3M document uses different

17:42:13 25 numbers. I actually didn't use their numbers.

17:42:17 1 Q. For the flow rate of a Bair Hugger blanket  
17:42:22 2 which is folded, you have -- or partially  
17:42:25 3 obstructed -- Would you say that's equivalent to being  
17:42:27 4 folded?  
17:42:28 5 A. Yes.  
17:42:28 6 Q. -- you have .023, and in the Bair Hugger  
17:42:31 7 testing they have 0.237; correct?  
17:42:35 8 A. Correct.  
17:42:36 9 Q. Okay. And for a open blanket you have .025  
17:42:40 10 and they have .0255; correct?  
17:42:43 11 A. That is correct.  
17:42:43 12 Q. Okay. So you're telling me that based on  
17:42:46 13 your experience with forced-air warming blankets that  
17:42:50 14 you predicted these numbers that were that similar to  
17:42:54 15 3M? Is that what you're saying here today, sir?  
17:42:58 16 MR. GOSS: There's no -- You asked him the  
17:42:59 17 question, there's no need for you to raise your  
17:43:01 18 voice, and I will --  
17:43:01 19 Q. Well there's nothing in these papers --  
17:43:03 20 MR. GOSS: -- and I will try to keep mine  
17:43:05 21 down, too.  
17:43:05 22 Q. There's nothing in the papers to answer that  
17:43:07 23 question. So I'm saying because this is off of your  
17:43:08 24 memory that you got these numbers; correct?  
17:43:10 25 A. No. That's not what I'm saying.

17:43:13 1 Q. So where'd you get your numbers from?

17:43:16 2 A. In fact I didn't use their numbers. These  
17:43:17 3 numbers are different.

17:43:21 4 What I'm saying, I've done many experiments  
17:43:23 5 on Bair Hugger and similar blankets. My recollection  
17:43:28 6 was that the -- the -- I recalled the flow rate  
17:43:33 7 through the Bair Hugger, it was very close, not the  
17:43:36 8 same as the Technical Data Sheet that we've got here,  
17:43:38 9 that confirmed that my answers -- my recollection was  
17:43:41 10 correct. But you notice I didn't take their numbers.  
17:43:45 11 I did not use their numbers as inputs.

17:43:48 12 Q. You just took it out to two significant  
17:43:50 13 places.

17:43:51 14 A. Well had I used their numbers, I -- and had  
17:43:54 15 I rounded, I would have had .024, and I have .023.  
17:43:59 16 They're close, but they're not the same. I did not  
17:44:03 17 solely rely on this. This confirmed my understanding.

17:44:07 18 Q. Where are the calculations or the documents  
17:44:08 19 that you got your numbers from?

17:44:11 20 A. It's from past work that I've done on Bair  
17:44:14 21 Huggers.

17:44:14 22 Q. Okay. So you have done work on a Bair  
17:44:16 23 Hugger 750 blower and a 522 blanket.

17:44:21 24 A. I didn't say that.

17:44:23 25 Q. Do you agree with me that every blanket will

17:44:26 1 have a different mass flow rate because of the  
17:44:28 2 resistance to the motor?

17:44:30 3 A. That is correct.

17:44:30 4 Q. Okay. And you agree with me that the 750  
17:44:35 5 has a different volumetric flow without a blanket than  
17:44:39 6 the 505 or the Smiths Medical or any other non-750  
17:44:44 7 blower out there.

17:44:46 8 A. I agree --

17:44:47 9 Q. Okay.

17:44:48 10 A. -- that blowers have a different flow rate.

17:44:55 11 Q. So sitting here today you're going to  
17:44:57 12 testify to a jury in Minnesota that you've obtained  
17:45:03 13 these very similar numbers to the Bair Hugger  
17:45:05 14 experiments that -- of Exhibit 9 based on your memory  
17:45:10 15 and experience of working with different forced-air  
17:45:14 16 warming devices.

17:45:17 17 A. What I can tell you is I had the number in  
17:45:21 18 my mind of what the flow rate through these systems  
17:45:23 19 were. I used this -- [Exhibit 9} I received this  
17:45:27 20 datasheet and it verified, hey, this is very close,  
17:45:32 21 and so I used my numbers.

17:45:35 22 Q. But your -- you can't reproduce your numbers  
17:45:38 23 from some physical document or even notes.

17:45:40 24 A. That is correct. I cannot.

17:45:42 25 Q. Okay. And in fact -- Strike that.

17:46:07 1 And based -- If you look at the last page of  
17:46:15 2 this document, you agree with me that they used -- if  
17:46:29 3 you look at the second-to-last sentence, they used  
17:46:32 4 Star CCM+ as the commercial CFD code.

17:46:36 5 MR. GOSS: Objection, lack of foundation.

17:46:37 6 You can testify as to whether he read that

17:46:41 7 correctly.

17:46:43 8 A. It says here: "In all scenarios Star CCM+,  
17:46:47 9 (a commercial CFD code) was used to model the air  
17:46:49 10 flows."

17:46:55 11 Q. I'm sorry. I missed what you said.

17:46:58 12 A. I read the sentence. I confirmed what the  
17:47:01 13 sentence said.

17:47:01 14 Q. Okay. And they actually used a polyhedral  
17:47:05 15 mesh of 12 million and some cells; correct?

17:47:09 16 A. That is --

17:47:10 17 MR. GOSS: Again, lack of foundation, and  
17:47:11 18 I'm going to actually stop any more questions about  
17:47:14 19 the CFD which was done internally which again we are  
17:47:17 20 asserting work-product protection over. He has not  
17:47:21 21 testified that he has seen any of it or relied on  
17:47:25 22 any -- any CFD imaging that may have been done  
17:47:27 23 internally by 3M.

17:47:28 24 MR. ASSAAD: Well first of all, you  
17:47:31 25 referenced this document early on in this deposition

17:47:33 1 about a document produced by Jennifer Wagner;

17:47:35 2 correct? And this was --

17:47:36 3 MR. GOSS: I'm not being deposed, Gabriel.

17:47:38 4 You can ask him the question.

17:47:39 5 MR. ASSAAD: Well we've had the records

17:47:40 6 indicate it, and you've had this document -- you

17:47:42 7 provided this document way back in January and now

17:47:44 8 you're claiming attorney work product?

17:47:46 9 MR. GOSS: You've had this document a long

17:47:49 10 time. I'm saying that the references to CFD that

17:47:51 11 were done internally, that is attorney work product

17:47:53 12 and we reserve the right to claw it back.

17:47:55 13 And you can ask him about what he

17:47:58 14 considered from this document with respect to his

17:48:00 15 opinions, but other than that I'm going to instruct

17:48:03 16 him not to speculate about anything in here that he

17:48:06 17 doesn't know anything about.

17:48:07 18 BY MR. ASSAAD:

17:48:07 19 Q. You understand CFD modeling; correct?

17:48:10 20 A. Yes.

17:48:11 21 Q. Okay. You understand that if you look at

17:48:12 22 here they used a RANS model, item number 7; correct?

17:48:17 23 MR. GOSS: I'm going to instruct you not to

17:48:19 24 answer anything based on lack of foundation and no

17:48:22 25 relevance to your opinions in this case.

17:48:25 1 Q. Correct?

17:48:27 2 MR. ASSAAD: Are you instructing him not to

17:48:28 3 answer?

17:48:29 4 MR. GOSS: Right.

17:48:29 5 MR. ASSAAD: Okay.

17:48:30 6 Q. You agree with me that 3M used an ideal gas

17:48:35 7 and did not use the Boussinesq according to their --

17:48:38 8 their -- the air physics that were followed; correct?

17:48:42 9 MR. GOSS: Is that something that you

17:48:43 10 considered for your opinions in this case?

17:48:45 11 THE WITNESS: No.

17:48:46 12 MR. GOSS: Then I instruct you not to

17:48:47 13 answer.

17:48:47 14 Q. Okay. You agree with me that they used a

17:48:51 15 K-epsilon two-layer buoyancy driven XU option;

17:48:55 16 correct?

17:48:56 17 MR. GOSS: Is that something that you

17:48:57 18 considered for your work in this case?

17:48:59 19 THE WITNESS: No.

17:48:59 20 MR. GOSS: Then I instruct you not to

17:49:01 21 answer.

17:49:01 22 Q. This document was provided to you; correct?

17:49:04 23 A. Correct.

17:49:05 24 Q. You received this document previously;

17:49:06 25 correct?

17:49:08 1 MR. GOSS: That's been well established,  
17:49:09 2 but --  
17:49:09 3 MR. ASSAAD: I'm asking him.  
17:49:10 4 MR. GOSS: -- you can answer again.  
17:49:11 5 MR. ASSAAD: Let me set up my case for the  
17:49:14 6 motion.  
17:49:14 7 A. Yes.  
17:49:14 8 Q. Okay. And actually, Jennifer Wagner, who  
17:49:16 9 assisted you in this case in some of the -- when you  
17:49:19 10 went to the OR, has also been provided a copy of this  
17:49:23 11 document.  
17:49:24 12 A. I don't know if that's true.  
17:49:25 13 Q. Okay. Well the fact that it says "Wagner  
17:49:31 14 0000013," I represent to you that she's the one that  
17:49:35 15 produced this document.  
17:49:36 16 MR. GOSS: You can wait for a question.  
17:49:45 17 Q. And you reviewed this document and  
17:49:47 18 considered it with respect to your opinions; correct?  
17:49:51 19 MR. GOSS: You can testify to what you  
17:49:53 20 considered out of this document with respect to your  
17:49:56 21 opinions.  
17:49:57 22 Q. You were provided this document before you  
17:49:59 23 did your CFD analysis.  
17:50:02 24 A. I don't know the answer to that. I don't  
17:50:04 25 know if I was.

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17:50:05 1 Q. Well it's dated October 15th, 2015; correct?

17:50:09 2 A. Yes.

17:50:10 3 Q. Okay. And you said you compared your

17:50:13 4 numbers to the numbers that were in this document

17:50:15 5 regarding mass flow; correct?

17:50:17 6 A. What I said was that --

17:50:22 7 Q. Let me rephrase. Your numbers --

17:50:24 8 Your memory and your experience confir --

17:50:27 9 was confirmed by the numbers in this document.

17:50:30 10 A. My memory was confirmed by the flow numbers

17:50:34 11 in Table 1 of this document.

17:50:50 12 MR. ASSAAD: Let's take a break.

17:50:52 13 THE REPORTER: Off the record, please.

17:50:55 14 (Recess taken from 5:50 to 5:58 p.m.)

17:58:08 15 BY MR. ASSAAD:

17:58:11 16 Q. I'd like to turn to page 5 of your report.

17:58:13 17 Are you there? I want to talk about validation, the

17:58:18 18 validated method; correct? That's what step 5 is;

17:58:21 19 correct?

17:58:21 20 A. Yes.

17:58:22 21 Q. Okay. It states here that you took

17:58:24 22 measurements of the room and you find it -- you found

17:58:27 23 it to be 61 degrees Fahrenheit during the procedure;

17:58:30 24 is that correct?

17:58:30 25 A. Correct.

17:58:31 1 Q. Where'd you take the measurements?

17:58:32 2 A. Multiple locations.

17:58:33 3 Q. Where?

17:58:34 4 A. All -- I walked all the way around the

17:58:37 5 perimeter of the OR table multiple times and I took

17:58:40 6 measurements at different heights.

17:58:41 7 Q. You agree the image that we put up regarding

17:58:43 8 the temperature differences in the room, that many of

17:58:47 9 the temperatures around the OR table were less than 61

17:58:50 10 degrees; correct?

17:58:51 11 A. Some temperatures were slightly less than

17:58:53 12 61.

17:58:54 13 Q. Okay. And by the way, do you believe that

17:58:56 14 your CFD showed -- only has 8.1 million cells?

17:59:02 15 A. I believe that's true.

17:59:03 16 Q. If the CFD showed that there was over 9

17:59:06 17 million, would you disagree with that, the TRN file?

17:59:09 18 A. No.

17:59:09 19 Q. Okay. So this would be incorrect about 8.1

17:59:12 20 million cells then; correct? That you've testified

17:59:14 21 earlier and that's in your validation.

17:59:18 22 A. Well would -- if -- if my TRN file shows

17:59:20 23 that I have 9 million cells, it means that, if

17:59:23 24 anything, it's more accurate.

17:59:26 25 Q. It just means that there's more cells. It

17:59:28       1    doesn't mean it's more accurate unless you do a  
17:59:31       2    quasi-steady solution judgment; correct?

17:59:36       3    A.    That --

17:59:36       4    Q.    I mean more cells don't mean it's more  
17:59:38       5    accurate; correct?

17:59:41       6    A.    That's not true. Most -- More cells, in  
17:59:45       7    almost every case, means more accurate. And in fact  
17:59:48       8    Elghobashi agreed with that.

17:59:49       9    Q.    Well if you have --

17:59:50       10    You did 60 million cells. Are you telling  
17:59:52       11    me the 60-million-cell solution is more accurate than  
17:59:55       12    the one provided in your report?

17:59:58       13    A.    Adding more cells always has the potential  
18:00:01       14    to make your results more accurate.

18:00:04       15    Q.    "Potential."

18:00:05       16    A.    That's right.

18:00:06       17    Q.    It doesn't mean it's more accurate. You  
18:00:07       18    might get the same solution whether you have 60  
18:00:11       19    million cells or 5 million cells.

18:00:13       20    A.    Yes, you're right.

18:00:15       21    Q.    Okay. So the -- So that statement is  
18:00:18       22    incorrect that the more cells automatically means it's  
18:00:21       23    more accurate. It may be more accurate, but it might  
18:00:23       24    not be.

18:00:24       25    A.    Correct. And I don't think I used the word

18:00:26 1 "automatically."

18:00:26 2 Q. Okay. So sitting here today I cannot

18:00:29 3 replicate where you took temperature measurements in

18:00:32 4 the room; correct?

18:00:35 5 A. I -- Well what you can --

18:00:38 6 What this document says and what's implied

18:00:41 7 by this document is multiple temperature measurements

18:00:43 8 were made, and the average was 61 Fahrenheit.

18:00:47 9 Q. I understand that. But if I want to

18:00:48 10 replicate exactly what you did, I have no way of

18:00:52 11 knowing exactly where you took the measurements;

18:00:54 12 correct?

18:00:54 13 A. That is correct.

18:00:54 14 Q. Okay. And also you took measurements three

18:00:57 15 inches off the floor and you measured that to be 60

18:01:00 16 degrees Fahrenheit; correct?

18:01:02 17 A. That is correct.

18:01:02 18 Q. And where were those measurements taken?

18:01:08 19 A. Those measurements were directly underneath

18:01:10 20 the head.

18:01:12 21 Q. Okay. Was it one measurement or two

18:01:14 22 measurements, or three?

18:01:16 23 A. It would have been multiple measurements.

18:01:20 24 Q. Sitting here today, do you know how many?

18:01:22 25 A. It would have been enough measurements so

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18:01:24 1 that I could get an average temperature that -- that  
18:01:28 2 -- I mean there's obviously some short-term time-wise  
18:01:33 3 fluctuations. This -- This number represents enough  
18:01:36 4 measurements that I got a steady temperature variable.  
18:01:39 5 Q. But you can't tell me how many; can you?  
18:01:42 6 Sitting here today.  
18:01:44 7 A. Correct.  
18:01:45 8 Q. And you have no notes to indicate actual --  
18:01:47 9 the numbers that you took down or the measurements;  
18:01:49 10 correct?  
18:01:51 11 A. Well the numbers that I took down are the  
18:01:52 12 numbers that we see here.  
18:01:54 13 Q. But to do an average you have multiple  
18:01:55 14 numbers; correct?  
18:01:58 15 A. You can have the --  
18:02:00 16 And I don't know if I did this. You can  
18:02:02 17 have the software do the averaging for you. And in  
18:02:05 18 that case you wouldn't extract the individual numbers.  
18:02:07 19 Q. Okay. But you need individual measurements  
18:02:09 20 to have an average; correct?  
18:02:11 21 A. That is correct.  
18:02:12 22 Q. Okay. And either the software did it or you  
18:02:13 23 did it to --  
18:02:15 24 A. Correct.  
18:02:16 25 Q. Okay. And sitting here today we don't have

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18:02:17 1 what those individual numbers are, and we will never  
18:02:20 2 be able to find out what those individual numbers are  
18:02:24 3 exactly; correct?  
18:02:24 4 A. Based on this document what you would know  
18:02:26 5 is that the temperature, the average temperature at  
18:02:29 6 that location is 60 or 60.5. You would not have the  
18:02:33 7 individual measurements that went into that number.  
18:02:36 8 Q. So you agree with me. Sitting here today, I  
18:02:38 9 cannot calculate what the average is based on  
18:02:41 10 individual measurements because we do not have those  
18:02:43 11 individual measurements; correct?  
18:02:44 12 A. I disagree.  
18:02:45 13 Q. How would I calculate an average unless I  
18:02:47 14 have the numbers?  
18:02:49 15 A. Well there are two sets of numbers here.  
18:02:51 16 One of them is calculated, and that means from the CFD  
18:02:56 17 model, so you could get that directly.  
18:02:58 18 Q. But validation is based --  
18:03:01 19 Your validation is based on experimental  
18:03:03 20 results; correct?  
18:03:03 21 A. Yes.  
18:03:04 22 Q. So if I want to test whether or not your  
18:03:07 23 experiments indicate that the temperature three inches  
18:03:11 24 above the floor -- the average temperature above the  
18:03:13 25 floor was 60.5 degrees, I would need the individual

18:03:18 1 numbers so I could calculate that average; correct?

18:03:21 2 A. If you wondered whether I know how to do an

18:03:24 3 average and you doubted that, then yes, you would need

18:03:27 4 the individual numbers.

18:03:28 5 Q. Okay. Because to calculate an average I

18:03:32 6 need actual numbers to calculate an average from;

18:03:34 7 correct?

18:03:34 8 A. That is correct.

18:03:35 9 Q. Okay. And that's not even college

18:03:40 10 mathematics, that's like middle school maybe, or

18:03:45 11 elementary? I don't know, but.

18:03:45 12 MR. GOSS: That's my level mathematics.

18:03:49 13 Q. So --

18:03:50 14 And you agree with me that as an engineer --

18:03:54 15 as -- it's good to, when you take measurements, to

18:04:01 16 document them contemporaneously when you take the

18:04:04 17 measurements; correct?

18:04:05 18 A. If it's needed. If that documentation's

18:04:07 19 necessary.

18:04:08 20 Q. Or if you're writing a report -- an expert

18:04:13 21 report in litigation and someone might want to

18:04:15 22 reproduce how you calculated the average that would be

18:04:19 23 something important to do; correct?

18:04:21 24 A. Calculating the average is so trivial I

18:04:24 25 wouldn't have even thought of doing that.

18:04:34 1 Q. Okay. Now you also did -- you used a fog  
18:04:37 2 generator to do fog -- to do tests on the airflow;  
18:04:38 3 correct?  
18:04:39 4 A. Correct.  
18:04:39 5 Q. Okay. And the fog generator was provided by  
18:04:42 6 3M; correct?  
18:04:43 7 A. Correct.  
18:04:44 8 Q. Okay. Have you ever used a fog generator  
18:04:46 9 before?  
18:04:51 10 A. Yes.  
18:04:53 11 Q. Do you recall --  
18:04:54 12 Do you know how long the -- you'd be able to  
18:04:57 13 see the fog in a high velocity or turbulent flow?  
18:05:02 14 A. It depends.  
18:05:03 15 Q. Depends on what?  
18:05:04 16 A. Depends on the speed, depends on whether the  
18:05:08 17 flow is disbursing, so the patterns of airflow,  
18:05:13 18 depends on the level of turbulence.  
18:05:20 19 Q. And did you calculate or determine how long  
18:05:26 20 you would be able to see the fog in the test that you  
18:05:29 21 conducted?  
18:05:29 22 A. No. It was not necessary.  
18:05:31 23 Q. I understand that you believe it's not  
18:05:33 24 necessary. But sitting here today, if I want to  
18:05:36 25 replicate something I need to know all the facts and

18:05:40 1 how things are done. So I understand you don't think  
18:05:42 2 it's necessary, but you never calculated those  
18:05:44 3 numbers; correct?

18:05:47 4 A. Well I'm struggling to understand --

18:05:49 5 Q. I'll withdraw that question.

18:05:50 6 Did you ever talk to the manufacturer to see

18:05:53 7 whether or not they recommended using this fog

18:05:55 8 generator to determine whether or not it was a proper

18:06:00 9 device to observe the airflow in an operating room?

18:06:07 10 A. That was complex. Could you re-ask the

18:06:09 11 question?

18:06:10 12 Q. Did you talk to the manufacturer of this

18:06:11 13 device, the fog generator, to determine whether or not

18:06:13 14 this device would be a -- a device that could produce

18:06:19 15 results that you could see in an operating room?

18:06:22 16 A. No. It was not necessary.

18:06:42 17 Q. Are you aware that the -- the person that

18:06:43 18 provided the device to 3M stated that in turbulent or

18:06:48 19 fast-moving air the fog generator would dissipate in

18:06:52 20 two feet due to mixing?

18:06:54 21 MR. GOSS: Object to form, lack of

18:06:55 22 foundation.

18:06:56 23 A. I've never heard the word "dissipate."

18:07:00 24 Q. Or dissipate. I'm sorry.

18:07:03 25 A. Could you read the sentence again?

18:07:04 1 Q. Are you aware that the person -- the company  
18:07:06 2 that provided the fog generator to 3M indicated to 3M  
18:07:11 3 that, in fast-moving air or turbulence it dissipates  
18:07:15 4 in a foot or two due to mixing with the air?

18:07:20 5 MR. GOSS: Object -- Same objection.

18:07:22 6 MS. ZIMMERMAN: Dissipates.

18:07:24 7 Q. Dissipates.

18:07:27 8 A. I'm not aware that they said that. I would  
18:07:27 9 say it begins to di -- that it dissipates all the  
18:07:30 10 time, but. So I don't know what the word "dissipates  
18:07:34 11 in two feet," I don't know what that phrase means.

18:07:36 12 Q. Which means that in turbulent air you might  
18:07:39 13 not be able to see the fog because it dissipates in a  
18:07:42 14 foot or two -- a foot or two.

18:07:45 15 MR. GOSS: Objection, lack of foundation  
18:07:45 16 with respect to this document, and misstatement.

18:07:48 17 You can testify to it if you know the  
18:07:50 18 answer.

18:08:02 19 (Abraham Exhibit 10 marked for  
20 identification.)

21 BY MR. ASSAAD:

18:08:05 22 Q. What's been marked as Exhibit 10 is Wagner  
18:08:08 23 0000001 that was produced in this case, and if you  
18:08:14 24 look, it's an email from Mr. Campbell from  
18:08:19 25 cleanroomfogger.com, or Clean Room Fogger, to Mr.

18:08:25 1 Fowler at GT Law. Do you know Mr. Fowler?

18:08:29 2 A. That name sounds familiar.

18:08:31 3 Q. If you look at paragraph two, it states:

18:08:38 4 "At the other end of the scale in fast moving air or

18:08:41 5 turbulence it dissipates in a foot or 2 due to mixing

18:08:45 6 with the air."

18:08:46 7 Were you told that information regarding

18:08:48 8 this fog generator that you used?

18:08:51 9 A. I was not, and it wasn't relevant.

18:08:54 10 Q. Okay. Well you saw the intensity model done

18:09:05 11 by Dr. Elghobashi; correct? In his report.

18:09:08 12 A. I recall turbulence intensity calculations.

18:09:11 13 Q. Okay. If Elghobashi is correct in his

18:09:14 14 report, you would agree with me that there is a --

18:09:19 15 there is -- there's more than two feet distance

18:09:22 16 between underneath the drape and the surgical site;

18:09:26 17 correct?

18:09:26 18 MR. GOSS: Object to form.

18:09:28 19 A. I don't understand that question.

18:09:29 20 Q. Well there's more than two feet of distance

18:09:32 21 that air would have to travel between underneath the

18:09:37 22 operating room table where the drape is, where the

18:09:39 23 drape -- the end of the drape, and where the knee was

18:09:42 24 in Dr. Elghobashi's model. You agree?

18:09:45 25 A. Are you asking --

18:09:47 1 I think you're asking is the physical  
18:09:49 2 distance between the bottom of the drape in his model  
18:09:53 3 and a knee more than two feet.  
18:09:55 4 Q. Yes.  
18:09:55 5 A. Is that what you're asking?  
18:09:57 6 I believe it is more than two feet.  
18:09:58 7 Q. Okay. So if the fog generator dissipates  
18:10:02 8 within one or two feet according to what Mr. Campbell  
18:10:11 9 states in this email, it's possible that you could use  
18:10:14 10 the fog generator and you're not going to see anything  
18:10:18 11 occur two feet away from where you insert the fog in a  
18:10:21 12 turbulent -- in turbulence.  
18:10:23 13 MR. GOSS: Objection to form, calls for  
18:10:25 14 speculation.  
18:10:26 15 A. I disagree. This document, when I read this  
18:10:30 16 document I see the words "fast-moving air" or  
18:10:33 17 "turbulence." What that means is high turbulence.  
18:10:35 18 What this person is saying is, look, this may not be  
18:10:39 19 the right device to use in those situations. Okay?  
18:10:45 20 They talk in other places in the email about the fog  
18:10:48 21 lasting a long time. For example, they say in the  
18:10:52 22 very same paragraph: "A few feet from the filter it  
18:10:55 23 can last up to 10 feet." So what this person appears  
18:10:58 24 to be warning Mr. Fowler of is, this device may not  
18:11:03 25 provide good visualization of airflow. That's what

18:11:07 1 they're saying. So then the question is, does it?

18:11:10 2 Does it adequately visualize airflow? And the fact

18:11:14 3 is, it does, and we showed that in our operating room

18:11:17 4 FloViz experiments.

18:11:21 5 THE VIDEOGRAPHER: Ten minutes.

18:11:37 6 Q. What test did you do to state that it would

18:11:39 7 show -- it would have enough life in it, I guess, for

18:11:45 8 lack of a better term, that you could see the fog

18:11:50 9 within more than two feet in a turbulent flow in the

18:11:52 10 operating room?

18:11:54 11 A. Well first of all we have visual evidence.

18:11:57 12 But secondly, the distance -- whether it can display

18:12:03 13 fog in a visual manner for two feet or not is

18:12:06 14 immaterial. What matters is does it display the fog

18:12:10 15 long enough for long enough distances so that you can

18:12:14 16 ascertain whether the Bair Hugger has an effect on

18:12:16 17 flow. And it was --

18:12:17 18 Q. And you would agree --

18:12:18 19 MR. GOSS: Let him finish.

18:12:20 20 MR. ASSAAD: I thought he was done.

18:12:22 21 MR. GOSS: Thank you.

18:12:22 22 THE WITNESS: Thank you.

18:12:23 23 A. And this fog device, in my professional

18:12:27 24 opinion, was able to show fog that extended long

18:12:30 25 enough to provide that conclusion.

18:12:36 1 Q. But sitting here today you do not know how  
18:12:39 2 long the -- the fog generator will last in a -- in  
18:12:44 3 turbulence that may be found in an operating room.

18:12:48 4 MR. GOSS: Object to form.

18:12:50 5 A. No one can say that because there's -- I  
18:12:53 6 mean, what this -- what this person is doing is  
18:12:56 7 they're warning you. They're saying, look, this  
18:12:59 8 device, which they appear to be selling, sometimes has  
18:13:04 9 fog that lasts a long time and sometimes it doesn't,  
18:13:08 10 so if you have fast-moving air or turbulence you might  
18:13:11 11 want to be careful.

18:13:12 12 Now the fact is we saw it last longer than  
18:13:14 13 two feet, and that tells me that we don't have much  
18:13:18 14 turbulence.

18:13:18 15 Q. Did you take any measurements?

18:13:23 16 A. Measure --

18:13:23 17 Q. Did you take any measurements to say, look,  
18:13:25 18 we consider this lasting four feet or five feet?  
18:13:30 19 Visual measurements.

18:13:31 20 A. There are visual measurements of how far it  
18:13:33 21 lasted in the videos.

18:14:28 22 Q. With respect to --

18:14:44 23 Are you familiar with the publication titled  
18:14:47 24 Resistive-Polymer Versus Forced-Air Warming:  
18:14:50 25 Comparable Efficiency in Orthopedic Patients, authored

18:14:53 1 by Sebastian Brandt?

18:14:56 2 A. I don't recall if I've read that one. It's  
18:14:59 3 possible, but I don't recall.

18:15:03 4 Q. By the way, are you aware that every single  
18:15:05 5 study that looked at either particles or neutrally  
18:15:13 6 buoyant bubbles showed an increase in bubbles or  
18:15:16 7 particles over the surgical site when the Bair Hugger  
18:15:18 8 was on?

18:15:19 9 MR. GOSS: Object to form.

18:15:21 10 A. I don't know about "every single study."  
18:15:23 11 I'm aware of some that report to show that, and many  
18:15:26 12 of them I'm not impressed with. I believe that there  
18:15:30 13 are flaws in the papers.

18:15:31 14 Q. What about the study that was funded and  
18:15:33 15 done by 3M?

18:15:35 16 A. There was a study funded and done by 3M, and  
18:15:38 17 that study, if I recall correctly, had particle  
18:15:44 18 differences within the uncertainty of the  
18:15:47 19 observations, so essentially the same. And also if I  
18:15:51 20 recall -- and I'm doing this from memory, and I  
18:15:53 21 shouldn't be doing this -- but if I recall, when heat  
18:15:55 22 was turned on in some cases the particles went down.  
18:16:00 23 So -- And then finally, as I recall, every scenario  
18:16:04 24 that they looked at met the protective standard.

18:16:10 25 Q. The protective effect.

18:16:12 1 A. They may have called --  
18:16:14 2 Q. The DIN standard. The DIN standard.  
18:16:17 3 A. I believe they used the DIN standard, but I  
18:16:18 4 can't confirm.  
18:16:18 5 Q. Hypothetically speaking if you were to find  
18:16:20 6 out that the particles in the 3M-funded study  
18:16:25 7 increased by a hundred-fold, would that affect whether  
18:16:30 8 or not, in your opinion, the Bair Hugger had an effect  
18:16:34 9 on the downward flow -- the unidirectional downward  
18:16:40 10 flow?  
18:16:41 11 MR. GOSS: Object to form,  
18:16:42 12 incomplete/improper hypothetical, calls for  
18:16:43 13 speculation.  
18:16:44 14 A. I would need to see the study to assess its  
18:16:47 15 quality.  
18:16:47 16 Q. Well you've seen the study, correct, and you  
18:16:49 17 said it was within the margin of error.  
18:16:51 18 A. Wait. Are you talking about a hypo --  
18:16:52 19 Q. I'm talking about the --  
20 A. Oh.  
18:16:53 21 Q. I'm talking about the Sessler study.  
18:16:55 22 A. I'm sorry. I thought you were talking about  
18:16:56 23 a hypothetical study.  
18:16:57 24 Q. Well I'm saying if that same study indicated  
18:17:00 25 that the particle counts increased by a hundred times

18:17:01       1 with the same methodology, the same measurements,  
18:17:04       2 would that change your -- would that have an effect on  
18:17:07       3 your opinions in this case of whether or not the Bair  
18:17:11       4 Hugger had an effect on the unidirectional downward  
18:17:14       5 flow?

18:17:14       6                   MR. GOSS: Same objections as before.

18:17:17       7                   A.     My recollection of that paper is that the  
18:17:20       8 results were within the uncertainty bounds, which  
18:17:23       9 means you could not say which scenario had more  
18:17:27       10 particles.

18:17:29       11                  My other recollection is that that study --  
18:17:34       12                  Did that study ever test the composition of  
18:17:38       13 the particles? I -- I don't recall that they did.  
18:17:43       14 And I don't believe that that study had humans  
18:17:48       15 involved. So there's a number of questions that I  
18:17:51       16 would have about the study, I would need to see it.  
18:17:53       17 But what I recall is that they were -- the results  
18:17:55       18 were within uncertainty.

18:17:57       19                  Q.     By the way, what do you mean by  
18:17:58       20 "significant"?

18:18:00       21                  A.     It depends on the context.

18:18:05       22                  Q.     So the term "significant" depends on the  
18:18:08       23 context with you?

18:18:13       24                  A.     Yes. For instance, it could mean  
18:18:16       25 statistically significant, and it could mean

18:18:19 1 qualitatively significant.

18:18:21 2 Q. Your opinion in your conclusion says: "My  
18:18:23 3 opinion is that forced-air patient warming does not  
18:18:26 4 disrupt airflow in a way that would present a  
18:18:28 5 significant risk of infection."

18:18:31 6 What do you mean by "significant" in that  
18:18:34 7 statement?

18:18:35 8 A. I mean that in the --

18:18:39 9 Oh, I was just waiting till you --

18:18:40 10 Q. No. Go ahead.

18:18:43 11 A. That statement does not refer to statistical  
18:18:46 12 significance. In that sense it means meaningful, or  
18:18:50 13 non-negligible.

18:18:52 14 Q. Okay. It doesn't mean any clinical  
18:18:55 15 significance; correct?

18:18:56 16 A. Correct.

18:18:56 17 Q. Okay. It just means to you meaningful  
18:18:58 18 significance.

18:18:59 19 A. That's right.

18:18:59 20 Q. Okay. And what the is the basis for this  
18:19:03 21 opinion?

18:19:04 22 A. I have a lot of opinions.

18:19:05 23 Could you read this one again so you can  
18:19:07 24 refresh my memory? It's late in the day.

18:19:07 25 Q. "My opinion is that forced-air patient

18:19:10 1 warming does not disrupt airflow in a way that would  
18:19:12 2 present a significant risk of infection."

18:19:14 3 A. It means what it says, that airflow from a  
18:19:16 4 device like the Bair Hugger does not stop the downward  
18:19:21 5 airflow from the ventilation system from washing over  
18:19:24 6 the surgical site.

18:19:25 7 MR. GOSS: He asked for the basis of that.

18:19:27 8 THE WITNESS: Oh, the basis?

18:19:28 9 Q. Yeah. Is it your CFD study?

18:19:30 10 A. That would be one of the bases.

18:19:33 11 And I apologize for not listening carefully  
18:19:35 12 to your question.

18:19:38 13 Q. Does the use of your term "significant" in  
18:19:40 14 that context, in that opinion, mean you recognize  
18:19:45 15 there may be some risk of infection?

18:19:48 16 A. No.

18:19:51 17 Q. Because you used the term "significant"  
18:19:53 18 risk, not "any" risk.

18:19:58 19 A. Correct. I used that term.

18:20:05 20 Q. And you're not a neurobiologist; correct?

18:20:10 21 A. Correct.

18:20:10 22 Q. And you don't -- you don't hold yourself out  
18:20:13 23 as an expert in microbiology; correct?

18:20:15 24 A. Correct.

18:20:15 25 Q. So sitting here today you don't know how

18:20:17       1 many bacteria or CFUs could cause a -- could be a  
18:20:21       2 significant risk of infection to a person that's  
18:20:23       3 having an implant surgery; correct?  
18:20:25       4           A.     That is correct.  
18:20:26       5           Q.     Okay. And -- Does the fact that Memarzadeh,  
18:20:58       6           that showed a slight disruption in laminar flow using  
18:21:02       7           the 505, did not use the 750 in his study and that  
18:21:06       8           might show a more increased disruption of laminar  
18:21:08       9           flow? If you recall?  
18:21:10       10          A.     Is this the Memarzadeh study where he had  
18:21:12       11          the air jets just emerging from the top of the  
18:21:16       12          patient?  
18:21:17       13          Q.     Yeah.  
18:21:17       14          A.     So there was no draping on it?  
18:21:19       15          Q.     Yes.  
18:21:20       16          A.     Boy, that's so different from this case.  
18:21:23       17          Q.     I think we can agree on something.  
18:21:25       18           That's a flaw by not having the patient  
18:21:26       19          being draped because the drape would affect airflow;  
18:21:28       20          correct?  
18:21:33       21          A.     If your model --  
18:21:35       22           So he may have been modeling a different  
18:21:37       23          surgery. I don't -- I don't recall what he was  
18:21:39       24          modeling.  
18:21:39       25          Q.     Okay.

18:21:40 1 A. And I don't recall the in -- the question --  
18:21:42 2 the scientific question he was trying to ask. So  
18:21:44 3 without looking at the paper I'm not prepared to say  
18:21:46 4 it was a -- it's a flaw in his model or not.  
18:21:49 5 Q. But if you didn't use drapes in your model,  
18:21:51 6 that would be a flaw; correct? Because you want a  
18:21:59 7 model as accurate as possible.  
18:22:00 8 A. No. I've never said that. You need to  
18:22:02 9 model the things that matter.  
18:22:04 10 Q. Okay.  
18:22:04 11 A. And some things matter.  
18:22:05 12 So, for example, the anesthesia screen  
18:22:07 13 matters. I mean, look, if I had the air oozing  
18:22:15 14 vertically outwards without a drape I think that that  
18:22:18 15 would matter, but that's not how I understand these  
18:22:20 16 surgeries are done.  
18:22:21 17 MR. ASSAAD: That's all I have.  
18:22:24 18 MR. GOSS: All right. A couple questions  
18:22:28 19 for you, Dr. Abraham.  
18:22:30 20 Should we -- I guess should we trade  
18:22:32 21 places, or does it matter?  
18:22:38 22 (Discussion off the stenographic record.)  
23 EXAMINATION  
24 BY MR. GOSS:  
18:22:40 25 Q. You brought some papers with you here today;

18:22:42 1 correct, Dr. Abraham?

18:22:43 2 A. That is correct.

18:22:44 3 Q. All right. And within that group there were

18:22:49 4 a couple of publications by Apte. You recall those?

18:22:54 5 A. Yes.

18:22:55 6 Q. All right. And you can refer to them if you

18:22:57 7 need to.

18:22:58 8 Why did you bring those papers?

18:23:11 9 A. It's my understanding that Apte is the

18:23:14 10 person who actually did the calculations, or perhaps

18:23:17 11 more accurate to say his graduate students. It's my

18:23:21 12 understanding Dr. Elghobashi did not do the

18:23:24 13 calculations himself. It's my understanding, based on

18:23:29 14 sitting in the deposition, that it wasn't Elghobashi's

18:23:32 15 software.

18:23:34 16 It is clear from Elghobashi's report that he

18:23:36 17 relied upon the Apte work and he relied upon citations

18:23:40 18 to Apte's code that reportedly showed validation. And

18:23:47 19 I would argue that when you look at these papers cited

18:23:49 20 by Elghobashi, they do not show validation.

18:23:52 21 Q. Why not?

18:23:56 22 A. Validation is best demonstrated by comparing

18:24:00 23 your results against an experiment. That's the

18:24:03 24 classic form of validation. And I can look at -- I am

18:24:08 25 citing Apte, Mahesh, Gorokhovski and Moin, 2009. And

18:24:14        1 I believe this was cited in the Elghobashi report as  
18:24:19        2 validation. In Figure 4 there's a comparison of  
18:24:25        3 simulations to experiments, and there is an "a" and a  
18:24:29        4 "b" part. And what we see is that there is a  
18:24:33        5 experimental error bar which is listed in the caption,  
18:24:36        6 and in some cases the simulation is outside of the  
18:24:39        7 error bar.

18:24:42        8 Q. By how much?

18:24:43        9 A. Well in -- in Figure 4 a it's hard to  
18:24:47        10 determine, maybe a hundred percent in some cases. But  
18:24:51        11 then there's Figure 5, the very next figure, and the  
18:24:55        12 caption says, "Comparison of normalized droplet  
18:25:00        13 mass-distribution at different axial locations." By  
18:25:03        14 the way, that's particle tracking. And there are  
18:25:08        15 experiments, and then there is the so-called LES  
18:25:11        16 calculation which I understand Elghobashi used in this  
18:25:14        17 case. And the errors there are approximately 400  
18:25:17        18 percent.

18:25:21        19 There was another Moin and Apte paper which  
18:25:28        20 shows the same experimental work. So this isn't just  
18:25:31        21 in one paper, it's in multiple ones.

18:25:33        22 Q. Is that paper cited by Dr. Elghobashi?

18:25:35        23 A. Yes, it is. And it is Moin and Apte 2006.  
18:25:41        24 And what's interesting about this second paper is we  
18:25:43        25 see something very interesting about the software.

18:25:47 1 Dr. Elghobashi mentioned in his deposition, once you  
18:25:50 2 validate for one case that's more complex and has all  
18:25:53 3 the ingredients, he said, you don't need to revalidate  
18:25:56 4 it. And I would argue strongly against that.

18:26:00 5 This is a case, it's a simulation that  
18:26:03 6 appears to be performed over a few centimeters' fluid  
18:26:08 7 domain, so a very small object, and the simulations  
18:26:12 8 were carried out to three milliseconds, and we see  
18:26:15 9 that in Figure 6.

18:26:18 10 It's my understanding that these papers do  
18:26:24 11 not, do not have buoyancy. So to say that a very  
18:26:28 12 small, very short-term simulation which is not well  
18:26:35 13 compared with experiments provides validation is, in  
18:26:39 14 my mind, an error.

18:26:41 15 I brought two other papers.

18:26:43 16 Q. What are those papers about?

18:26:47 17 A. These are papers that have been referenced  
18:26:52 18 in the course of this litigation. One is Belani, the  
18:26:58 19 year is 2012. And another one is McGovern, et al.,  
18:27:02 20 year 2011.

18:27:03 21 Q. Why did you bring those papers?

18:27:09 22 THE VIDEOGRAPHER: Two minutes left on the  
18:27:11 23 tape.

18:27:11 24 THE WITNESS: This'll be fast.

18:27:17 25 A. In a section called "Total Knee Replacement

18:27:20        1 Experiment Setup" from the Belani paper it says:  
18:27:24        2 Bubbles were introduced at the head and neck of the  
18:27:27        3 mannequin to track under drape resident air movements  
18:27:30        4 in the region where...excess patient warming heat was  
18:27:33        5 being released." In --  
18:27:36        6 Q. Why is that statement significant to you?  
18:27:39        7 A. Well, it agrees with where I had the Bair  
18:27:42        8 Hugger air enter the room. And in fact that's  
18:27:44        9 confirmed by the other paper, which is McGovern.  
18:27:47        10 Now they're working on hip replacement. So  
18:27:49        11 this is knee and hip. And they say -- I've got to  
18:27:57        12 find it. Ahh. Bubbles were introduced at the floor  
18:28:00        13 level between the surgeon's body and the operating ta  
18:28:05        14 -- Let's see. Hold on. That may not be the right  
18:28:08        15 one. I have to find it. Oh, here.  
18:28:09        16 I'm in the section called "**Experimental**  
18:28:11        17 **Setup: Hip Replacement.**" Bubbles were introduced at  
18:28:14        18 the head and neck region of the mannequin to track  
18:28:16        19 under-drape resident air movements in the region where  
18:28:19        20 the excess heat from the patient warming was being  
18:28:22        21 released.  
18:28:23        22 So the documents relied upon by the  
18:28:26        23 plaintiffs agree with my supposition of where the heat  
18:28:30        24 enters the room.  
18:28:33        25 MR. ASSAAD: I have a couple follow-up, if

18:28:35 1 you're not done.

18:28:36 2 MR. GOSS: Okay. So we better change the  
18:28:37 3 tape.

18:28:40 4 (Recess taken from 6:28 to 6:30 p.m.)

5 (Abraham Exhibits 11 - 14 marked  
6 for identification.)

7 BY MR. GOSS:

18:30:57 8 Q. All right, Dr. Abraham. Showing you Exhibit  
18:31:00 9 11, "Stochastic modeling of atomizing spray in a  
18:31:04 10 complex swirl injector using large eddy simulation."  
18:31:10 11 Is that one of the Apte papers that you were  
18:31:13 12 discussing earlier?

18:31:14 13 A. Yes, it is.

18:31:15 14 Q. Okay. And this is one of the papers that  
18:31:18 15 was referred to -- or was this one of the papers  
18:31:21 16 referred to by Dr. Elghobashi as validating his CFD?

18:31:26 17 A. Yes.

18:31:27 18 Q. In your opinion, does it validate his CFD?

18:31:29 19 A. No.

18:31:31 20 Q. Exhibit 12 is a reference "Large-Eddy  
18:31:35 21 Simulation of Realistic Gas Turbine Combustors," by  
18:31:40 22 Moin and Apte. Is that an article or publication  
18:31:46 23 cited by Dr. Elghobashi as validation of his CFD?

18:31:49 24 A. Yes, it is.

18:31:51 25 Q. In your opinion does that validate his CFD?

18:31:53 1 A. It does not.

18:31:57 2 Q. Exhibit 13 is McGovern, et al. "Forced-air

18:32:05 3 warming and ultra-clean ventilation do not mix."

18:32:07 4 And this is the paper from which you were

18:32:11 5 reading about the -- the location of the helium --

18:32:18 6 neutrally buoyant helium bubbles being released around

18:32:23 7 the head and neck of the mannequin; is that correct?

18:32:25 8 A. Yes.

18:32:26 9 Q. All right. And finally, Exhibit 14 is

18:32:30 10 Belani, et al., "Patient Warming Excess Heat: The

18:32:34 11 Effects of Orthopedic Operating Room Ventilation

18:32:37 12 Performance," and is that another paper where the

18:32:43 13 experiment released the flow tracer from the head and

18:32:47 14 neck area of a mannequin?

18:32:49 15 A. Yes, it is.

18:32:51 16 Q. And in that paper there was a statement that

18:32:56 17 -- that that is where the excess heat from the Bair

18:32:58 18 Hugger was released; is that correct?

18:33:00 19 A. Correct.

18:33:01 20 Q. You attended Dr. Elghobashi's deposition;

18:33:05 21 correct?

18:33:06 22 A. Correct.

18:33:06 23 Q. And that was after you submitted your report

18:33:10 24 in this case on January -- I'm sorry -- June 2nd;

18:33:14 25 correct?

18:33:14 1 A. Correct.

18:33:16 2 Q. Did you form opinions as a result of --

18:33:23 3 Well first of all, let me ask you: Why did

18:33:25 4 you attend Dr. Elghobashi's deposition?

18:33:30 5 A. His report was not written in a clear way

18:33:33 6 and I had questions about how his analysis was done.

18:33:36 7 Q. And what did you learn from that analysis?

18:33:39 8 A. I learned that my initial critiques still

18:33:43 9 held, and in fact I -- are strengthened.

18:33:52 10 Q. Okay.

18:33:52 11 (Interruption by the reporter.)

18:33:53 12 Q. And are you prepared to offer opinions at

18:33:55 13 trial based on the information you obtained during Dr.

18:33:59 14 Elghobashi's deposition?

18:34:00 15 A. Yes, I am.

18:34:03 16 Q. Now yesterday you saw a document from Dr.

18:34:09 17 Elghobashi called Exhibit B to his errata sheet. Do

18:34:15 18 you recall that?

18:34:15 19 A. Yes.

18:34:16 20 Q. Did you have an opportunity to review that?

18:34:18 21 A. Yes.

18:34:19 22 Q. And are you prepared to offer --

18:34:22 23 Well first of all, what did you determine

18:34:24 24 from your review of that document?

18:34:26 25 A. His analysis is in error.

18:34:29 1 Q. Okay. And are you prepared to offer  
18:34:31 2 opinions at trial with respect to that analysis?  
18:34:35 3 A. Yes, I am.  
18:34:37 4 Q. What errors specifically did you identify in  
18:34:42 5 -- in that Exhibit B to the errata sheet?  
18:34:46 6 A. Do you have it? Could I look at it?  
18:34:48 7 Q. Yes.  
18:34:48 8 A. Or I could do it by memory.  
18:34:52 9 MR. ASSAAD: Just for the record, I'm going  
18:34:53 10 to need at least another half -- you're bringing up  
18:34:56 11 new issues that are not raised in his report, stuff  
18:34:58 12 that's not cited in his report, and if we're going  
18:35:01 13 along this path of new opinions I'm going to request  
18:35:03 14 another 30 minutes to an hour to go over these  
18:35:05 15 documents that I haven't had a chance to go over till  
18:35:09 16 today, or his opinions.  
18:35:12 17 MR. GOSS: Well it's his errata sheet.  
18:35:14 18 It's --  
18:35:19 19 MR. ASSAAD: And he did not --  
18:35:15 20 MR. GOSS: -- Dr. Elghobashi's errata  
18:35:16 21 sheet.  
18:35:16 22 MR. ASSAAD: He did not cite any of these  
18:35:18 23 documents or any of this rebuttal opinions in his  
18:35:21 24 report.  
18:35:21 25 MR. GOSS: Well of course he didn't. This

18:35:23 1 all happened after the report.

18:35:23 2 MR. ASSAAD: He's had those documents that

18:35:25 3 were cited by Abraham -- or by Elghobashi prior to

18:35:29 4 the deposition and prior to the submission of his

18:35:30 5 report. He did not put any of those critiques

18:35:34 6 regarding Apte's papers --

18:35:38 7 MR. GOSS: We can go as long as you need.

18:35:39 8 MR. ASSAAD: Okay.

18:35:40 9 MR. GOSS: That's fine.

18:35:42 10 MR. ASSAAD: Fair enough.

18:35:43 11 MR. GOSS: All right. I need to take a

18:36:09 12 break to copy this real quick.

18:36:11 13 THE REPORTER: Off the record, please.

18:37:34 14 (Recess taken from 6:37 to 6:39 p.m.)

18:37:34 15 (Abraham Exhibit 15 marked for

18:37:34 16 identification.)

18:39:04 17 BY MR. GOSS:

18:39:04 18 Q. All right. So Exhibit 15 is, I will

18:39:09 19 represent to you, even though it doesn't say "Exhibit

18:39:12 20 B" on top of it, this is a copy of Exhibit B to Dr.

18:39:16 21 Elghobashi's errata sheet.

18:39:18 22 MR. GOSS: I will say for the record that

18:39:19 23 we consider it to be an improper submission,

18:39:22 24 nevertheless, since Dr. Abraham is here and has

18:39:26 25 reviewed it, I will present it to him and ask him to

18:39:31 1 testify as to --

18:39:33 2 Q. Well, let me just ask you:

18:39:35 3 What errors did you identify in this Exhibit

18:39:38 4 B? Or Exhibit 15. Sorry.

18:39:42 5 A. There were a number of errors. For  
18:39:45 6 instance, his Figure 3 is incorrect. His Figure 3  
18:39:51 7 shows an arm with a heated-air gap and then inflated  
18:39:58 8 tube, so the blanket is actually elevated over the  
18:40:01 9 arm. And that's not how these devices operate. These  
18:40:05 10 devices operate where the ar -- the blanket wraps  
18:40:10 11 around the arm and touches the arm. So there is not  
18:40:16 12 a, the word is coaxial arm and blanket. That doesn't  
18:40:21 13 occur.

18:40:22 14 Q. Okay. Did you identify other errors in this  
18:40:26 15 Exhibit 15?

18:40:28 16 A. I did.

18:40:30 17 Q. Okay.

18:40:30 18 A. Another error that I identified is with his  
18:40:35 19 convective heat transfer coefficient which he used,  
18:40:38 20 and that is seen in equation 3. He's used a value of  
18:40:44 21 the convective heat transfer coefficient which is  
18:40:47 22 artificially low, his value is 5. My own research  
18:40:51 23 shows a value of about 11. So that's a error of a  
18:40:56 24 factor of two.

18:40:58 25 Q. Okay. And I realize you only saw this for

18:41:03       1 the first time yesterday, but did you formulate any  
18:41:06       2 other impressions of potential errors in this  
18:41:10       3 submission?  
18:41:10       4 A.     Yes.  
18:41:11       5 Q.     Okay.  
18:41:12       6 A.     He describes air supposedly moving around  
18:41:17       7 the arm from the blanket, and then he says -- he  
18:41:23       8 calculates an air velocity of .514 meters per second.  
18:41:29       9 Sitting here right now I don't recall if he ever used  
18:41:31      10 that number in his report. But what he says next is  
18:41:37      11 important. He says: "It should be noted that this is  
18:41:40      12 the velocity before the air reaches the drape that  
18:41:42      13 covers the blanket. The air will then leave the drape  
18:41:47      14 edges" at a lower velo -- "at a lower velocity as  
18:41:51      15 shown in Figure 4." And then he has arrows pointing  
18:41:56      16 to a red outline of the lower edge of the drape, and I  
18:42:02      17 believe that that is physically impossible. It is  
18:42:05      18 impossible for hot air to travel to the arrowed  
18:42:10      19 locations as he describes.  
18:42:13      20 Q.     And what's the length of the arrow  
18:42:16      21 locations; does he indicate?  
18:42:22      22 A.     I -- He --  
18:42:23      23 There's no indication that I see --  
18:42:25      24 Q.     Okay.  
18:42:26      25 A.     -- of the length.

18:42:27 1 Q. Okay. Any other issues with Exhibit 15 that  
18:42:31 2 you've been able to identify in the last 24 hours?  
18:42:48 3 A. Yes.  
18:42:49 4 Q. Okay.  
18:42:51 5 A. In Figure 5 he has a schematic for heat  
18:42:55 6 transfer from the air to the body, and he has two  
18:42:58 7 temperatures listed there which are both in error. He  
18:43:02 8 lists the body temperature of 37 degrees Celsius; it  
18:43:06 9 is not, that is too high. He lists the blower air  
18:43:09 10 temperature at the inlet of 41. And while I recognize  
18:43:15 11 that these devices operate with different blower  
18:43:18 12 temperatures, in my opinion this should be the inlet  
18:43:23 13 temperature to the blanket of 43 Celsius.  
18:43:30 14 Q. Okay.  
18:43:31 15 A. And those are the key issues.  
18:43:34 16 Q. All right. Now on the back of one of those  
18:43:37 17 pages there are some notations?  
18:43:39 18 A. Yes.  
18:43:40 19 Q. All right. Did you make those notations?  
18:43:42 20 A. Yes, I did.  
18:43:43 21 Q. And what are those?  
18:43:45 22 A. Those are written equations called the  
18:43:50 23 Navier-Stokes equations.  
18:43:51 24 Q. All right. And why did you write those out?  
18:43:53 25 A. Because I was anticipating that I would be

1 asked to write them in the deposition, and out of an  
18:44:00 2 abundance of caution I reminded myse -- they're very  
18:44:04 3 complex, so I had to remind myself of all the terms.

18:44:07 4 Q. All right.

18:44:08 5 MR. GOSS: That's all I have for you, sir.

6 EXAMINATION

7 BY MR. ASSAAD:

18:44:10 8 Q. How did you remind yourself?

18:44:14 9 A. I wrote them a number of times over and  
18:44:17 10 over.

18:44:18 11 Q. Were you looking at a book?

18:44:19 12 A. No.

18:44:20 13 Q. You did it off your memory.

18:44:22 14 A. No. I actually put the equations in my  
18:44:24 15 journal paper, and so I just transcribed them from the  
18:44:27 16 journal paper.

18:44:28 17 Q. Okay. So you didn't just write them off  
18:44:30 18 your memory, you actually looked at another document  
18:44:32 19 to write them down.

18:44:34 20 A. That is correct.

18:44:35 21 Q. And you practiced them because you thought I  
18:44:37 22 was going to ask you that question today.

18:44:39 23 A. I would say I memorized them. There's many  
18:44:41 24 terms, and I wanted to make sure I had every term  
18:44:47 25 correct.

18:44:48 1 Q. Okay. All right.

18:44:49 2 Let's first talk about validation. You

18:44:51 3 listed two papers, Exhibits Number 12 and 11, written

18:44:59 4 by one of the authors of Apte; correct?

18:45:03 5 A. Correct.

18:45:04 6 Q. And you're using this to prove that -- to

18:45:07 7 show that the code is not validated; correct?

18:45:12 8 MR. GOSS: Object to form.

18:45:13 9 Q. That's what my understanding was.

18:45:14 10 I could be incorrect, but that's what my

18:45:16 11 understanding was.

18:45:17 12 A. Dr. Elghobashi cited a number of references

18:45:20 13 of Elghobashi that he says demonstrated validation.

18:45:23 14 In my mind those articles do not demonstrate

18:45:26 15 validation.

18:45:27 16 Q. So they demonstrate --

18:45:28 17 So they don't demonstrate validation, in

18:45:30 18 your mind, with regard to Elghobashi's validation;

18:45:33 19 correct?

18:45:34 20 A. Correct.

18:45:35 21 Q. And just -- just to clarify, you've had Dr.

18:45:39 22 Elghobashi's report since March; correct?

18:45:43 23 A. I don't know --

18:45:44 24 That seems a little early. I don't know

18:45:46 25 when I received it.

18:45:47 1 Q. But you had the -- you had his report that  
18:45:49 2 -- report that these two articles are cited prior to  
18:45:52 3 submitting your expert report on June 2nd; correct?

18:45:56 4 A. That is correct.

18:45:56 5 Q. And these critiques of validation are being  
18:45:59 6 raised for the first time by you today; correct? To  
18:46:05 7 at least -- To at least the plaintiffs.

18:46:06 8 A. No. I critiqued him in validation in my  
18:46:09 9 expert report.

18:46:09 10 Q. But you did not use these two documents in  
18:46:11 11 your critique; correct?

18:46:12 12 A. That is correct.

18:46:13 13 Q. The first time you've raised to the  
18:46:14 14 plaintiffs the -- the critique of Elghobashi's  
18:46:18 15 validation with respect to these two articles, Exhibit  
18:46:22 16 11 and 12, is today; correct?

18:46:24 17 A. Correct.

18:46:24 18 Q. Okay. And you understand that the deadline  
18:46:53 19 of June 2nd, 2017 was for the defense to provide  
18:46:57 20 rebuttal reports to plaintiffs' expert reports.

18:47:01 21 MR. GOSS: Object to form. He's not a  
18:47:02 22 lawyer.

18:47:03 23 You can testify if you have an  
18:47:04 24 understanding about that.

18:47:09 25 A. When I went to Elghobashi's deposition I

1 heard something that I disagreed with. What I heard  
18:47:16 2 was that if a code is validated for one case, it could  
18:47:20 3 automatically be used for another case provided the  
18:47:24 4 ingredients were the same. Now he said that in his  
18:47:26 5 deposition. That was not in his expert report.  
18:47:30 6 Following that deposition I inquired, was his  
18:47:35 7 statement at his deposition correct.

18:47:39 8 So you've asked me a question about a  
18:47:42 9 deadline? I'm not aware of the legal deadlines in  
18:47:46 10 this case.

18:47:46 11 Q. Okay. You agree that with respect to codes  
18:47:56 12 that are written for CFD, such as the one that  
18:47:58 13 Elghobashi used, it's always an ongoing process;  
18:48:00 14 correct?

18:48:02 15 A. Not necessarily.

18:48:03 16 Q. Well you agree that the Stanford code that  
18:48:07 17 was used is maintained and run by Ph.D. students that  
18:48:10 18 keep on updating it on a yearly basis, providing new  
18:48:14 19 code to solve problems.

18:48:16 20 MR. GOSS: Object to lack of foundation.

18:48:17 21 A. I have no basis to know that.

18:48:19 22 Q. Okay. So you don't know what the current  
18:48:20 23 code is -- the current state of the code as of 2017 is  
18:48:25 24 of the code that Elghobashi used; correct?

18:48:28 25 A. Correct. The only thing --

18:48:29 1 Q. Okay. And --  
2 A. -- I know is --  
18:48:30 3 Q. -- And -- And --  
18:48:30 4 MR. GOSS: Let him finish. We're --  
18:48:32 5 Q. And moving forward, you agree that --  
18:48:33 6 MR. GOSS: Now we're off the clock. He can  
18:48:35 7 give a full answer.  
18:48:36 8 MR. ASSAAD: Okay. That's fine.  
18:48:37 9 A. The only thing that I know is based on the  
18:48:39 10 technical information in his report.  
18:48:40 11 Q. Okay. And -- And the technical information  
18:48:43 12 you look at Exhibit 12, which is dated 2006; correct?  
18:48:48 13 A. Say that again.  
18:48:49 14 Q. The article's written in 2006; correct?  
18:48:53 15 A. It was published in 2006.  
18:48:55 16 Q. So it could have been written in 2005.  
18:48:56 17 A. That's correct.  
18:48:57 18 Q. Okay. So that is approximately 11 years  
18:49:01 19 ago; correct?  
18:49:02 20 A. Yes.  
18:49:02 21 Q. So you don't know what, if any, change in  
18:49:05 22 the code occurred between the publication of this  
18:49:06 23 paper and the code that Elghobashi used; correct?  
18:49:09 24 A. What I know --  
18:49:10 25 Q. "Yes" or "no," sir? "Yes" or "no"?

18:49:12 1 MR. GOSS: No --

18:49:13 2 Q. You don't know what has occurred between

18:49:15 3 2006 and 2017 with respect to the code that Dr.

18:49:19 4 Elghobashi used; correct?

18:49:21 5 MR. GOSS: Time is no longer an issue.

18:49:22 6 MR. ASSAAD: I want him to answer my

18:49:24 7 question.

18:49:24 8 MR. GOSS: You can answer it, and you can

18:49:26 9 provide your explanation.

18:49:27 10 MR. ASSAAD: That's fine. As long as I get

18:49:29 11 a "yes" or a "no," then he could...

18:49:30 12 A. Can you ask the question again?

18:49:32 13 Q. You don't know what has changed in the code

18:49:35 14 between April of 2006, the date of this publication,

18:49:37 15 and 2017; isn't that correct?

18:49:41 16 A. That is correct.

18:49:41 17 Q. Okay.

18:49:42 18 A. What I do know is that that's a paper he

18:49:44 19 cited as supporting the validation of the code he used

18:49:48 20 in this case.

18:49:49 21 Q. Okay. And you agree with me that Exhibit

18:49:53 22 Number 11, it was published in 2009.

18:49:56 23 A. I agree.

18:49:58 24 Q. Okay. And you agree with me that you don't

18:50:01 25 know any changes in the code that was use -- that was

18:50:02        1     made between 2009 and 2017 if any changes were made;  
18:50:06        2     correct?  
18:50:07        3               A.     I have the same answer as the prior question  
18:50:10        4     you asked, which is, yes, I do not know.  
18:50:13        5               Q.     Okay.  
18:50:13        6               A.     But that was a document cited in his expert  
18:50:16        7     report.  
18:50:16        8               Q.     But --  
18:50:17        9               And you agree that you could -- you could  
18:50:19        10   validate CFD analysis based on the code being  
18:50:31        11   validated in prior experiments.  
18:50:38        12              A.     Can you ask that -- That's a cumber --  
18:50:41        13              I'm struggling to understand your question.  
18:50:42        14              Q.     Well you cited to Exhibit 11 and 12 saying  
18:50:46        15   that you disagree with Dr. Elghobashi validating his  
18:50:49        16   code on articles 11 and 12; correct?  
18:50:52        17              A.     Correct.  
18:50:52        18              Q.     Okay. Which means that you could validate  
18:50:55        19   your CFD analysis based on more complex experiments  
18:50:59        20   made with the same code; correct?  
18:51:04        21              A.     That is possible, but not necessarily true.  
18:51:07        22              Q.     Okay. And you cited a paper written by  
18:51:10        23   Oberkampf and Trucano. You recall that; correct?  
18:51:13        24              A.     Yes.  
18:51:13        25              Q.     And you would agree with me that in that

18:51:17        1 paper it states, because of the infeasibility and  
18:51:19        2 impracticability of conducting true validation  
18:51:23        3 experiments on most complex systems, the recommended  
18:51:26        4 method is to use a building-block approach.

18:51:28        5                  Do you agree with that?

18:51:29        6                  A.   Yes.

18:51:29        7                  Q.   Okay. And you testified earlier that the  
18:51:33        8 CFD modeling that was done in this by you and by  
18:51:36        9 Elghobashi was a complex system; correct?

18:51:38        10                 A.   Yes.

18:51:39        11                 Q.   Okay. And you're an alumnus of the  
18:51:51        12 University of Minnesota; correct?

18:51:52        13                 A.   Yes.

18:51:52        14                 Q.   You could have went and talked to Krishnan  
18:51:55        15 Mahesh and got what actually the Stanford code is  
18:51:58        16 validated for or not; correct?

18:52:00        17                 MR. GOSS: I'll object to form.

18:52:02        18                 A.   I don't know. I mean, I -- I think  
18:52:06        19 Elghobashi said it was a proprietary code.

18:52:09        20                 Q.   You understand that the people that work on  
18:52:11        21 the code from Stanford take it with them and they're  
18:52:13        22 allowed to use it, just like Elghobashi was allowed to  
18:52:17        23 use it, as well as other people.

18:52:18        24                 MR. GOSS: Lack of foundation.

18:52:21        25                 A.   I do not understand that.

18:52:22 1 Q. Okay.

18:52:22 2 (Interruption by the reporter.)

18:52:22 3 Q. Well you understand there's codes out there

18:52:26 4 written by universities that are proprietary; correct?

18:52:29 5 A. Yes.

18:52:29 6 Q. And that many students or Ph.D.s work on

18:52:34 7 that code and refine that code over time.

18:52:36 8 A. Yes.

18:52:37 9 Q. Okay. And the Stanford code is an example;

18:52:39 10 correct?

18:52:40 11 A. Yes.

18:52:40 12 Q. And actually The University of Minnesota has

18:52:42 13 its own code; correct?

18:52:44 14 A. Possibly. I don't know.

18:52:45 15 Q. You don't know.

18:52:46 16 A. Correct.

18:52:47 17 Q. Okay. And you still have ties to the

18:52:54 18 University of Minnesota; correct?

18:52:56 19 A. Define "ties."

18:52:57 20 Q. You still have relationships with your --

18:52:58 21 with Sparrow; correct?

18:53:00 22 A. Yes.

18:53:01 23 Q. Okay. St. Thomas doesn't have its own code;

18:53:05 24 correct?

18:53:06 25 A. St. Thomas uses ANSYS.

18:53:08 1 Q. Okay. You agree with me that if the code  
18:53:45 2 Elghobashi used was validated for more complex systems  
18:53:49 3 used in this case, the same type of math -- for the  
18:53:52 4 same type of physics and mathematics, that  
18:53:56 5 Elghobashi's CFD is validated.

18:53:59 6 MR. GOSS: Object to form.

18:54:01 7 A. I would agree that if it was validated for  
18:54:03 8 as complex or more complex of a case of the same  
18:54:07 9 nature, then...

18:54:13 10 No, I would not agree.

18:54:14 11 Q. You wouldn't.

18:54:15 12 A. No.

18:54:15 13 Q. Okay. So you disagree with the article that  
18:54:17 14 you wrote that I just read to you.

18:54:20 15 A. Say --

18:54:21 16 Read that statement again.

18:54:25 17 Q. You recall citing this article in your -- in  
18:54:27 18 your report.

18:54:27 19 A. Yes.

18:54:28 20 Q. Okay. Have you read this article?

18:54:30 21 A. Yes.

18:54:30 22 MR. GOSS: This is an article that he  
18:54:31 23 wrote?

18:54:32 24 MR. ASSAAD: He cited.

18:54:32 25 MR. GOSS: You said he wrote it.

18:54:34 1 MR. ASSAAD: I said he cited in his report.

18:54:36 2 MR. GOSS: Okay. I thought you said he

18:54:38 3 wrote it. I'm sorry.

18:54:40 4 Q. You've read this entire article?

18:54:42 5 A. Yes.

18:54:43 6 Q. Okay. When's the last time you read this

18:54:44 7 article?

18:54:45 8 A. Awhile ago. I can't --

9 Q. Okay.

18:54:47 10 A. I can't recall.

18:54:47 11 Q. It's a large article; correct?

18:54:49 12 A. It was heavy reading.

18:54:51 13 Q. Okay. And in the article which you said you

18:54:53 14 agreed with... No. I withdraw that question.

18:55:01 15 Let me go to a different part, if I can find

18:55:05 16 it.

18:55:08 17 By the way, do you agree that this article's

18:55:11 18 authoritative on verification and validation in

18:55:14 19 computational fluid dynamics?

18:55:17 20 A. I don't know what the word "authoritative"

18:55:19 21 means in this context.

18:55:20 22 Q. But you cited it; correct?

18:55:22 23 A. I cited it as a representation of how these

18:55:26 24 issues are viewed in the community.

18:55:28 25 Q. Okay. So this is --

18:55:30 1 You agree with me this is how -- these are  
18:55:32 2 how -- these are how verification and validation --  
18:55:35 3 validation issues are viewed in the fluid dynamics  
18:55:38 4 community; correct?

18:55:39 5 A. Yes.

18:55:40 6 Q. Okay. Definitely not my community. You  
18:55:42 7 agree with that.

18:55:44 8 A. Possibly.

18:55:45 9 Q. Definitely not Peter Goss's community.

18:55:47 10 MR. GOSS: Well that we can stipulate to.

18:55:56 11 Q. Now you agree with me that Elghobashi put  
18:56:00 12 down calculations and computations that you were able  
18:56:03 13 to observe and critique; correct? For example,  
18:56:08 14 Exhibit Number 15. He wrote down his calculations;  
18:56:14 15 correct?

18:56:15 16 A. I believe that is from him, and yes, it does  
18:56:18 17 show a calculation.

18:56:19 18 Q. So someone such as yourself could look at  
18:56:21 19 what he did to calculate what he did and either agree  
18:56:23 20 with it or critique it; correct?

18:56:25 21 A. Correct.

18:56:25 22 Q. Okay. And you did not do such a thing with  
18:56:30 23 respect to your initial boundaries; correct?

18:56:33 24 A. Incorrect.

18:56:35 25 Q. Please show me the calculations. Please

18:56:37 1 show me one addition that you've provided that has a  
18:56:43 2 mathematical equation to the plaintiff in this case.  
18:56:48 3 A. Well I think that the question's become  
18:56:50 4 confused.  
18:56:51 5 Q. No, it hasn't become --  
18:56:53 6 If it's confused, I'll re-ask it.  
18:56:54 7 MR. GOSS: He may not --  
18:56:55 8 MR. ASSAAD: I'll re-ask it.  
18:56:55 9 MR. GOSS: -- understand what you're  
18:56:56 10 asking.  
18:56:56 11 Q. I'll re-ask it.  
18:56:58 12 Elghobashi provided you calculations of how  
18:57:01 13 he did things; correct?  
18:57:02 14 A. Correct.  
18:57:03 15 Q. And there are actual equations; correct?  
18:57:05 16 A. Correct.  
18:57:06 17 Q. With numbers.  
18:57:06 18 A. Correct.  
18:57:07 19 Q. With solutions.  
18:57:08 20 A. Correct.  
18:57:09 21 Q. With heat value coefficients; correct?  
18:57:15 22 A. Correct.  
18:57:16 23 Q. That you as a -- a -- a person in the field  
18:57:20 24 of mechanical engineering can look at it and critique  
18:57:24 25 it and determine whether or not it's correct or not;

18:57:27 1 correct?

18:57:28 2 A. Correct.

18:57:28 3 Q. And that's what you did in this case. You

18:57:30 4 saw what he did and you say, I disagree.

18:57:32 5 A. That's right.

18:57:33 6 Q. Correct?

18:57:33 7 And you did not provide one equation to the

18:57:41 8 plaintiffs that we could do the same type of critique

18:57:44 9 that you did to Elghobashi; correct?

18:57:46 10 MR. GOSS: You mean other than the TRN

18:57:47 11 file?

18:57:49 12 Q. There's no equations in the TRN file; are

18:57:52 13 there?

18:57:53 14 A. Well, I mean, the equations are built into

18:57:55 15 the software so you can't really separate the

18:57:57 16 equations from the software. But here is -- here is

18:58:00 17 the issue --

18:58:00 18 Q. My question --

18:58:02 19 Let me ask it simple, simple. In Exhibit 1,

18:58:04 20 2 or any of the exhibits we saw today that were

18:58:07 21 produced by you, okay, except for the Elghobashi

18:58:11 22 exhibits or any of the citations --

18:58:13 23 Let's go back. Exhibit 1 and 2 of your

18:58:18 24 report, your CV, as well as your expert report, you

18:58:22 25 agree with me that there is not one mathematical

1 equation that was provided to the plaintiffs in this  
18:58:31 2 case.

18:58:32 3 A. There is no equation.

18:58:34 4 Q. So you agree with me. "Yes" or "no"?

18:58:36 5 A. I agree with you, --

18:58:37 6 Q. Okay.

18:58:38 7 A. -- but the information is listed there that  
18:58:41 8 would allow someone to reproduce the results.

18:58:44 9 Q. Okay. You agree with me that there's not  
18:58:46 10 one mathematical equation in your expert report;  
18:58:49 11 correct?

18:58:49 12 MR. GOSS: I think he -- I think he  
18:58:50 13 answered that.

18:58:52 14 A. I agree, --

18:58:53 15 Q. Okay.

18:58:53 16 A. - and it's not necessary.

18:58:54 17 Q. And you agree with me there's not one number  
18:58:56 18 or -- like equation that uses numbers to show what you  
18:58:59 19 did to make any of your assumptions in your expert  
18:59:03 20 report; correct?

18:59:04 21 MR. GOSS: Asked and answered.

18:59:06 22 A. I agree, I think I've answered that.

18:59:44 23 Q. Okay. You disagree with Figure 3 of Exhibit  
18:59:49 24 15; correct?

18:59:51 25 A. Yes.

18:59:52 1 Q. Okay. Do you have any experimental or  
18:59:55 2 scientific equations, besides the fact that you just  
18:59:58 3 sit here today and say you disagree, to support your  
19:00:01 4 -- your -- your critique of Figure 3?

19:00:05 5 MR. GOSS: Do you have the exhibit in front  
19:00:07 6 of you?

19:00:07 7 MR. ASSAAD: I showed it to him already.

19:00:09 8 MR. GOSS: Oh.

19:00:12 9 A. Figure 3 shows --

19:00:14 10 Q. That wasn't my question. I know what Figure  
19:00:16 11 3 shows.

19:00:16 12 I'm asking you, do you have any mathematical  
19:00:19 13 equations or calculations or anything to support your  
19:00:22 14 critique of Figure 3?

19:00:23 15 A. Yes.

19:00:23 16 Q. Where?

19:00:24 17 A. I have direct observation. I have worked on  
19:00:26 18 these devices for years. The blanket touches the  
19:00:29 19 skin. There -- The arm is not in a concentric space  
19:00:34 20 within the blanket. That is not how these devices  
19:00:37 21 work.

19:00:38 22 Q. So your opinion is that the blanket touches  
19:00:43 23 the skin?

19:00:45 24 A. Yes.

19:00:46 25 Q. So the blanket would have a significant heat

19:00:50 1 transfer by conduction from the blanket to the skin;  
19:00:53 2 correct?  
19:00:54 3 MR. GOSS: Object to form.  
19:00:55 4 A. All of the heat is transferred via -- via  
19:00:57 5 convection.  
19:00:58 6 Q. Really?  
19:00:59 7 A. Yes.  
19:01:01 8 Q. Would you -- I mean, your critique is that  
19:01:10 9 -- Strike that.  
19:01:10 10 Do you not think that the -- the blanket  
19:01:14 11 itself, the -- that's not the pores heats up?  
19:01:18 12 A. I do believe the pores heat up.  
19:01:20 13 Q. So if it's touching the skin, you don't  
19:01:22 14 think it transfers heat by conduction?  
19:01:24 15 A. How did the heat get there in the first  
19:01:26 16 place? All of the heat that is transferred from the  
19:01:29 17 heater to the patient is by convection. Absolutely.  
19:01:33 18 Q. You'd bet your career on that, that all the  
19:01:35 19 heat is transferred from the Bair Hugger by convection  
19:01:38 20 to the patient? You willing to bet your career on  
19:01:41 21 that?  
19:01:41 22 MR. GOSS: I think you're talking about two  
19:01:43 23 different things.  
19:01:43 24 MR. ASSAAD: No. He knows exactly what I'm  
19:01:45 25 talking about.

19:01:45 1 MR. GOSS: That's argumentative.

19:01:46 2 I think we covered this earlier, but if you

19:01:48 3 have a different answer, you can provide it.

19:01:51 4 A. I would --

19:01:51 5 MR. GOSS: If you don't, you can stand by

19:01:52 6 your testimony.

19:01:53 7 A. I would never bet my career on the word

19:01:56 8 "all." But here's what I'll say. This device is

19:02:00 9 designed and operated in a way where air is heated up,

19:02:04 10 that air is blown into an inflatable blanket, and that

19:02:09 11 air oozes out of the pores against the skin. That

19:02:14 12 transfer of heat from the heater within the Bair

19:02:17 13 Hugger base to the body is convection.

19:02:22 14 Q. You sure about that?

19:02:23 15 A. Yes.

19:02:24 16 Q. So you're telling me engineering principles

19:02:26 17 of heat transfer that --

19:02:28 18 I mean you agree with me that you could heat

19:02:30 19 something by convection -- I could heat this paper

19:02:39 20 with a hot air blower by convection; correct?

21 [Demonstrating.]

19:02:41 22 A. Correct.

19:02:42 23 Q. And this paper is going to warm up; correct?

19:02:45 24 A. Yes.

19:02:46 25 Q. Okay. And if I take this paper and put this

19:02:49        1 pen to it, okay, how's the paper warming up the pen;  
19:02:53        2 by convection or by conduction?  
19:02:55        3            A. In that case it's a two-step process. The  
19:02:59        4 ultimate heat transfer is by convection, and it passes  
19:03:02        5 through the paper by conduction.  
19:03:04        6            Q. And then it passes to the pen by conduction;  
19:03:07        7 correct?  
19:03:08        8            A. Well once it's into the pen there's no issue  
19:03:10        9 of conduction.  
19:03:11        10          Q. You said it passes into the paper by  
19:03:13        11 conduction; correct?  
19:03:14        12          A. No. No. It pa -- If I said that, it was a  
19:03:16        13 mistake.  
19:03:17        14          Q. Okay. It passes --  
19:03:18        15            It heats up the paper by convection;  
19:03:20        16 correct?  
19:03:21        17          A. Yes.  
19:03:21        18          Q. And then the paper passes heat -- or  
19:03:25        19 transfers heat to the pen that's touching it by  
19:03:29        20 conduction; correct?  
19:03:30        21          A. If there is contact, the heat is transferred  
19:03:32        22 through a wall by conduction.  
19:03:35        23          Q. Okay. Okay. So the transfer of heat from  
19:03:38        24 the piece of paper to the pen in this example -- I'm  
19:03:42        25 going to put it in front of the camera -- is by

19:03:46 1 conduction.

19:03:47 2 A. Through an impermeable surface, the transfer  
19:03:51 3 across the surface is by conduction. The transfer to  
19:03:55 4 the object initially is convection.

19:03:57 5 Q. Okay. You agree with me that the -- the  
19:04:03 6 only way air escapes out of the Bair Hugger is through  
19:04:07 7 the pores.

19:04:09 8 A. No.

19:04:10 9 Q. How else would it escape?

19:04:12 10 A. Because when the hose connects with the  
19:04:16 11 blanket there may be imperfections in that connection,  
19:04:21 12 but I would say this. The majority of the air escapes  
19:04:23 13 through the holes.

19:04:24 14 Q. Okay.

19:04:26 15 A. And that air impinges on the skin, and that  
19:04:28 16 is a convective heat transfer process.

19:04:30 17 Q. Okay. What about the part where the plastic  
19:04:34 18 -- or the Bair Hugger bottom layer is heated? Not  
19:04:37 19 where the pores are, but the space in between the  
19:04:40 20 pores, okay? If that touches the patient, you agree  
19:04:44 21 that the heat transfer from that plastic Bair Hugger  
19:04:49 22 layer to the patient where there's contact is  
19:04:52 23 conduction.

19:04:53 24 A. I would agree that the heat transfer across  
19:04:55 25 the plastic is conduction, but the origination of the

19:04:58 1 heat is by convection.

19:05:00 2 Q. I understand that.

19:05:01 3 I think you and I are speaking two different  
19:05:03 4 things, because you could heat by convection, but then  
19:05:06 5 it's going to warm objects that might transfer heat by  
19:05:09 6 conduction; correct?

19:05:12 7 Even though the initial source --

19:05:14 8 A. The convective heat is transferred through  
19:05:16 9 -- could be transferred through the wall by  
19:05:18 10 conduction.

11 Q. Okay.

19:05:18 12 A. I would say that.

19:05:19 13 Q. So if the Bair Hugger is -- the plastic, not  
19:05:22 14 the -- where the jets are, but the non-jet areas or  
19:05:25 15 perforations are touching the patient, there is going  
19:05:28 16 to be heat transfer from that solid Bair Hugger wall  
19:05:34 17 to the patient.

19:05:36 18 MR. GOSS: Objection, I think it  
19:05:38 19 mischaracterizes the Bair Hugger.

19:05:39 20 But if you understand it, you can testify  
19:05:41 21 to it.

19:05:42 22 A. Can you ask the question again?

19:05:48 23 (Discussion off the stenographic record.)

19:05:48 24 MR. GOSS: It's not a solid wall.

19:05:49 25 Q. You're assuming that the Bair Hugger is

19:05:51 1 touching the patient; correct? And that's why you  
19:05:54 2 critique Figure 3.

19:05:55 3 A. The critique I have of Figure 3 is that it  
19:05:58 4 describes a situation which doesn't exist. That is,  
19:06:02 5 it's got a solid arm centrally located, and I think I  
19:06:07 6 may have used the word, like, axisymmetrically  
19:06:11 7 something located within a circle that is the blanket.  
19:06:17 8 And that's not how this thing works, and that's not  
19:06:21 9 how it operates.

19:06:24 10 So what he's done here is he's imagined  
19:06:28 11 long, straight, rectangular slots through which the  
19:06:32 12 air ejects downwards, and that is not how these  
19:06:35 13 devices operate.

19:06:36 14 Q. Well you agree that the air is ejected  
19:06:38 15 downwards; correct?

19:06:39 16 A. No.

19:06:41 17 Q. Where is the Bair Hugger air blowing?

19:06:43 18 A. Against the skin.

19:06:46 19 Q. Okay. Hypothetically speaking I am four  
19:06:50 20 feet tall and I stretch out my hands and the Bair  
19:06:53 21 Hugger goes past the end of my hand, the air over --  
19:06:58 22 in that area that goes past my hand, is that ejecting  
19:07:00 23 down?

19:07:02 24 A. That --

19:07:04 25 I mean, that's a hypothetical. From my

19:07:07 1 understanding of operating room tables, that air would  
19:07:10 2 be ejected against... I don't know. I'd have to see  
19:07:16 3 it. I'd have -- I don't know.

19:07:18 4 Q. So sitting here today, you don't know.

19:07:19 5 A. Correct.

19:07:19 6 Q. Okay. And how wide is the -- is the arm  
19:07:24 7 where the -- where the arm extension is, like the arm  
19:07:27 8 pad and board; do you know?

19:07:29 9 A. I do not know.

19:07:30 10 Q. Okay. And what's the -- the dimensions of  
19:07:39 11 the Bair Hugger Blanket 522?

19:07:41 12 A. I don't know the numbers off the top of my  
19:07:42 13 head.

19:07:43 14 Q. Have you seen one?

19:07:44 15 A. Yes.

19:07:44 16 Q. Have you measured one?

19:07:47 17 A. I don't recall measuring the physical  
19:07:49 18 dimensions of one.

19:07:50 19 Q. Have you received the schematics of one?

19:07:52 20 A. Not that I recall.

19:07:53 21 Q. Do you disagree with the measurements that  
19:07:55 22 Elghobashi put in Figure -- Figure 1 with respect to  
19:08:00 23 the dimensions?

19:08:03 24 A. I have no reason to disagree.

19:08:04 25 Q. Okay. You disagree with the body

19:08:31 1 temperature of 37 degrees Celsius; correct?

19:08:33 2 A. I disagree that that's the skin temperature.

19:08:35 3 Q. Okay. What would you put here as the skin

19:08:37 4 temperature?

19:08:40 5 A. The skin temperature depends on the

19:08:41 6 environment, but a good estimate would be about 35

19:08:44 7 degrees.

19:08:45 8 Q. So you're saying that --

19:08:46 9 A. Maybe 36.

19:08:48 10 Q. 36 degrees? Okay.

19:08:49 11 A. 35 or 36.

19:08:50 12 Q. Okay. Let's just assume it's 35 degrees.

19:08:53 13 How much would that change his calculations

19:08:55 14 by?

19:08:56 15 A. I did not put corrected numbers in to test

19:08:59 16 that.

19:09:00 17 Q. Okay. So it might only change it

19:09:03 18 insignificantly; correct?

19:09:06 19 A. No.

19:09:06 20 MR. GOSS: Calls for speculation.

19:09:08 21 Q. Well we've talked that --

19:09:08 22 You don't know how much it would change?

19:09:10 23 A. No. Let me see this. Let me --

19:09:12 24 Q. Why don't you calculate for me how much it

19:09:14 25 would change?

19:09:15 1 MR. GOSS: He's had this for a day. I  
19:09:18 2 don't think --  
19:09:18 3 MR. ASSAAD: If he's going to critique it  
19:09:20 4 and every little bit, I want to know --  
19:09:22 5 MR. GOSS: He's going to offer additional  
19:09:24 6 critiques, because he's only had this for a day, but  
19:09:27 7 he can -- he can -- he can do his best to respond to  
19:09:30 8 your questions.  
19:09:31 9 MR. ASSAAD: Would you agree --  
19:09:32 10 Would you want to just reconvene this  
19:09:34 11 deposition, then, so he has time to critique it?  
19:09:37 12 A. No. I can critique it now.  
19:09:39 13 Q. Okay.  
19:09:39 14 A. So let's take the air temperature which he  
19:09:42 15 has as 41, and I think a more appropriate number would  
19:09:46 16 be 43.  
19:09:46 17 (Witness starting to mark an exhibit.)  
19:09:49 18 A. Actually let me just -- Let's put forty --  
19:09:54 19 (Interruption by the reporter.)  
19:09:54 20 (Discussion off the stenographic record.)  
19:09:54 21 A. Let me just do it in my mind.  
19:09:58 22 So he's using 41 minus 37, that's a  
19:10:00 23 temperature difference of four degrees. I think a  
19:10:02 24 more accurate set of numbers would be 43 to 35, which  
19:10:09 25 is eight degrees, so that's a factor of two. He also

19:10:14 1 is off by --

19:10:14 2 Q. Before I finish. When -- Is "T" in the

19:10:17 3 equations Celsius or Kelvin?

19:10:21 4 A. Celsius.

5 Q. Okay.

19:10:21 6 A. He's off by a factor of two in his "h"

19:10:24 7 value, so that's --

19:10:24 8 Q. I'm just talking about the temperature now.

19:10:26 9 A. You just want me to --

19:10:29 10 Q. If you changed the temperature to what you

19:10:30 11 thought it would be, how much would it affect the

19:10:32 12 results of his -- of his tem --

19:10:35 13 A. One hundred percent.

19:10:37 14 Q. One hundred --

19:10:37 15 A. He would be off by a hundred percent.

19:10:39 16 Q. Okay. And you -- you think the temperature

19:10:41 17 coming out of the Bair Hugger, the air is 43 degrees

19:10:44 18 Celsius?

19:10:45 19 A. Well that would be the maximum temperature.

19:10:48 20 It's my understanding that's the maximum temperature

19:10:50 21 of the air entering the Bair Hugger.

19:10:52 22 MR. GOSS: Blanket; correct?

19:10:55 23 THE WITNESS: Blanket.

19:10:55 24 Q. Well he's talking about the Bair -- air

19:10:58 25 coming out of the Bair Hugger, and in the gap between

19:11:00 1 the Bair Hugger blanket and the surface of the body.

19:11:02 2 So your testimony today is that air coming

19:11:05 3 out of the Bair Hugger is 43 degrees Celsius?

19:11:07 4 A. No.

19:11:09 5 Q. You used 41 degrees; correct?

19:11:11 6 A. I did, but you're mixing what he's done and

19:11:15 7 -- You're mixing things up.

19:11:16 8 Q. He put down the blower air, then the gap

19:11:20 9 between the blanket surface and the body, and then the

19:11:24 10 exit temperature; correct?

19:11:28 11 A. Yes. He put that down.

19:11:30 12 Q. Okay. So if he's referring to the air

19:11:33 13 coming out of the blanket, you would have no critique

19:11:35 14 of the 41 degrees Celsius temperature.

19:11:40 15 That's what you used.

19:11:43 16 A. Well it's hard to answer because...

19:11:47 17 I mean, you might be right. You might be

19:11:49 18 right. Let me think about this.

19:11:54 19 The air entering the blanket is 43, so some

19:11:58 20 of the air comes out at forty -- some of the air is

19:12:02 21 coming out hotter, some of it's coming out colder.

19:12:05 22 Okay. So if what he has done is assume that all the

19:12:09 23 air comes out at 41, then I take that criticism back.

19:12:14 24 That would be an average. That would be an

19:12:16 25 appropriate upper bound average.

19:12:19 1 Q. Okay.

19:12:19 2 A. But that still doesn't correct his

19:12:22 3 temperature-drop calculations.

19:12:24 4 Q. Okay. Well the other critique is he put 37,

19:12:27 5 and you might think it's 35 or 36; correct?

19:12:31 6 A. Correct. And the "h" value.

19:12:32 7 Q. Okay. Not there yet.

19:12:34 8 You said he had an "h" value of 5; correct?

19:12:42 9 A. Correct.

19:13:32 10 Q. Do you disagree with the reference he used

19:13:34 11 to determine his "h" value?

19:13:36 12 A. Can you remind me that reference?

19:13:37 13 Q. R. J. De Dear, E. Arens, titled -- a couple

19:13:43 14 of authors -- titled "Convective and Radiative Heat

19:13:48 15 Transfer Coefficients For Individual Human Body

19:13:50 16 Segments."

19:13:52 17 A. That paper --

19:13:55 18 So I've actually done research on convective

19:13:57 19 coefficients between forced-air warming blankets and

19:14:01 20 bodies, and the values that we calculated were 10 to

19:14:06 21 11. Now that reference I don't believe pertains to

19:14:12 22 forced-air warming blankets.

19:14:16 23 If I read that document -- See it doesn't

19:14:19 24 mention anything in the title about forced-air warming

19:14:21 25 blankets. If I read that document and I find that it

19:14:26 1 is related to forced-air warming blankets then I would  
19:14:28 2 revise my criticism, but I don't believe it is. I  
19:14:31 3 think he used an inappropriate value that's off by a  
19:14:34 4 hundred percent.

19:14:35 5 Q. Okay. And where would I find your value of  
19:14:38 6 11?

19:14:39 7 A. In my CV. I've got a journal paper  
19:14:42 8 published -- I think it's called Whole Body Warming  
19:14:46 9 Hypothermia something, but it's there.

19:14:49 10 Q. Is that the one with Vallez and Plourde,  
19:14:51 11 Plourde?

19:14:51 12 A. I --  
19:14:53 13 No, it's not that one that we're talking  
19:14:55 14 about. It's a different paper.

19:14:56 15 Q. Okay. Who funded that research?

19:14:59 16 A. That was funded by Smiths Medical.

19:15:03 17 Q. Okay. Now go to Belani, and...

19:15:38 18 You're not critiquing Dr. Elghobashi for the  
19:15:40 19 fact that he wrote down all his equations and  
19:15:43 20 assumptions; are you?

19:15:44 21 A. No.

19:15:44 22 Q. Okay. I mean, you agree that significant  
19:15:51 23 assumptions should be provided in a expert report or  
19:16:00 24 publication; correct?

19:16:01 25 MR GOSS: We're getting beyond the scope of

19:16:02 1 my redirect, but you can answer that.

19:16:07 2 A. I do agree significant assumptions --

3 Q. Okay.

19:16:09 4 A. -- should be listed.

19:16:47 5 Q. So you cite to McGovern with respect to

19:16:50 6 their bubble tests; correct? That they put the bubble

19:16:53 7 testing at the -- at the front of the anesthesia drape

8 --

19:16:59 9 THE REPORTER: They put the bubble testing?

19:16:59 10 Q. -- at the head, at the -- in the front of

19:17:02 11 the anesthesia drape where the head is; correct?

19:17:04 12 A. Correct.

19:17:05 13 Q. Okay. And you believe that's the correct

19:17:08 14 way of --

19:17:12 15 You believe they did that because you think

19:17:14 16 they felt that that's where the excess air was coming;

19:17:19 17 correct?

19:17:20 18 MR. GOSS: Lack of foundation.

19:17:20 19 A. I can only --

19:17:21 20 I mean, I don't know what they were

19:17:22 21 thinking, I only know what's in their report, and

19:17:25 22 what's in their report contradicts Dr. Elghobashi.

19:17:28 23 Q. Are you aware that Dr. McGovern, Albrecht,

19:17:33 24 Dr. Belani, Nachtsheim and Reed were all deposed in

19:17:38 25 this case?

19:17:40 1 A. I am aware McGovern and Albrecht were  
19:17:43 2 deposed. I don't know if any others.  
19:17:44 3 Q. Have you read their depositions?  
19:17:46 4 A. Yes.  
19:17:52 5 Q. I asked you before whether or not you read  
19:17:54 6 any fact witness depositions and you said you haven't  
19:17:57 7 read any since December of 2015. Do you recall that?  
19:18:04 8 A. Yeah. Maybe I thought they were expert  
19:18:07 9 witnesses. I don't -- I may have -- I may have made  
19:18:10 10 an error, but I certainly read them. I thought I told  
19:18:12 11 you that. And if I didn't, I apologize.  
19:18:15 12 Q. And I've also asked you what expert  
19:18:17 13 depositions you've read and you did not mention these  
19:18:19 14 people at all either; did you?  
19:18:21 15 A. I don't know if that's true.  
19:18:22 16 Q. Well you --  
19:18:23 17 MR. GOSS: So if you want to ask him about  
19:18:25 18 that testimony, you have an opportunity to.  
19:18:27 19 Q. Did you have that testimony prior to  
19:18:28 20 providing -- doing your report in this case?  
19:18:31 21 A. No.  
19:18:31 22 Q. So you got it after you submitted your  
19:18:33 23 report?  
19:18:35 24 A. Correct.  
19:18:40 25 Q. And you didn't cite to any of their

19:18:42 1 testimony or their depositions in your expert report;

19:18:45 2 correct?

19:18:46 3 A. That is correct.

19:18:46 4 Q. Or in Exhibit C, which was documents you

19:18:49 5 considered that were outside of your expert report;

19:18:50 6 correct?

19:18:52 7 A. Boy, I'd have to check. Do we have Exhibit

19:19:04 8 3?

19:19:04 9 Q. Right there. Exhibit 3.

19:19:09 10 A. Those depositions are not cited here.

19:19:12 11 Q. Okay. Do you consider the report by Dr.

19:19:26 12 McGovern, which is Exhibit 13, reliable?

19:19:29 13 A. No.

19:19:37 14 Q. Were you --

19:19:38 15 Did you find this report independently, or

19:19:40 16 was it given to you by counsel?

19:19:43 17 A. I don't recall. I was given a number of

19:19:46 18 documents and then I performed my own literature

19:19:49 19 search. I don't recall using any of the documents

19:19:51 20 given to me by counsel.

19:19:52 21 Q. So you found this document on your own then;

19:19:56 22 correct?

19:19:56 23 A. I believe I did, but I don't know for sure.

19:19:58 24 Q. What search terms did you use?

19:20:01 25 A. Oh man. I may have used laminar flow,

19:20:10 1 operating room, forced-air warming. I don't recall  
19:20:12 2 the search terms I used.

19:20:16 3 Q. Would the same apply to the Belani article  
19:20:19 4 marked Exhibit 14?

19:20:20 5 A. Same answer.

19:20:22 6 Q. So I assume you pulled up more than these  
19:20:24 7 two articles; correct?

19:20:26 8 A. What do you mean by "pulled up"?

19:20:27 9 Q. Like you did some independent research and  
19:20:30 10 provided -- you found articles on the Bair Hugger  
19:20:31 11 which you cited in your references, and Exhibit C, if  
19:20:36 12 there are any -- or Exhibit 3, I'm sorry, and these  
19:20:40 13 two articles; correct?

19:20:42 14 A. Well there's many articles, but I think  
19:20:44 15 those articles are actually in my expert report.

19:20:46 16 Q. Okay. Okay. Do you agree with me that,  
19:22:15 17 with respect to Exhibit 15, that the equations that  
19:22:23 18 Dr. Elghobashi used are the correct equations?

19:22:28 19 A. Can you point out which equations you're  
19:22:30 20 referring to?

19:22:35 21 Q. The equations on top of page 2 where he  
19:22:43 22 calculates the volumetric flow rate over the gap area?

19:22:53 23 A. The mathematics is done correctly, but this  
19:22:57 24 equation represents something that doesn't happen  
19:23:00 25 physically, so it's a meaningless equation.

19:23:02 1 Q. Okay. But the equation is a correct equa --  
19:23:04 2 the mathematics are correct, you don't think the  
19:23:08 3 equation itself is correct.  
19:23:11 4 A. Just doing it in my head it appears the  
19:23:14 5 numbers work out. So the left -- the right-hand side  
19:23:17 6 is obtained when you put the left-hand side numbers  
19:23:20 7 in.  
19:23:20 8 Q. Okay. Maybe the better question is this:  
19:23:33 9 Assuming that Figure 3 is correct, okay, and based off  
19:23:38 10 Figure 3 you want to calculate the velocity of the  
19:23:42 11 flow coming out, is the equation correct to use that  
19:23:45 12 veloci -- to calculate that velocity, if Figure 3 is  
19:23:48 13 correct?  
19:23:48 14 MR. GOSS: Object to form.  
19:23:51 15 A. No.  
19:23:52 16 Q. What's wrong with it?  
19:23:53 17 How would you calculate the velocity of the  
19:23:56 18 air coming out of the Bair Hugger over that area?  
19:24:00 19 A. What he has ignored, eve --  
19:24:02 20 Q. I'm asking how you would calculate it.  
19:24:06 21 A. I would calculate it differently.  
19:24:08 22 Q. How would you calculate it?  
19:24:09 23 A. I'm going to tell you.  
19:24:11 24 Q. Please do.  
19:24:12 25 A. I would cal -- I do not believe --

19:24:14 1 Q. Actually, let's write it down.

19:24:15 2 MR. GOSS: Hold on.

19:24:16 3 Q. Let's -- Write it down.

19:24:17 4 MR. GOSS: Hold on. Let him answer.

19:24:17 5 MR. ASSAAD: Okay.

19:24:19 6 MR. GOSS: He's not going to obey your

19:24:22 7 command to write anything. Let him answer the

19:24:22 8 question.

19:24:23 9 Q. Feel free to write it down if you know how.

19:24:26 10 MR. GOSS: Object. Move to strike.

19:24:29 11 A. And can you tell me the question again, the

19:24:31 12 specific --

19:24:32 13 Q. What equation would you use to calculate the

19:24:34 14 velocity of the air coming out of the Bair Hugger

19:24:37 15 assuming that Figure 3 is correct?

19:24:46 16 Do you need a pen?

19:24:47 17 A. Hold on. The velocity of the air coming out

19:24:49 18 of the Bair Hugger?

19:24:50 19 Q. Yes. Blanket. Blanket.

19:24:51 20 A. The equation that I would use is I would

19:24:54 21 take the number of holes, multiplied by the area of

19:24:58 22 the holes, and that would be the total jet area, and

19:25:07 23 then I would take the flow rate divided by that area.

19:25:12 24 That's how I'd get the velocity of the air emerging

19:25:15 25 from the Bair Hugger.

19:25:15 1 Q. Do you think the number of holes in a Bair  
19:25:17 2 Hugger is a constant from blanket to blanket?  
19:25:20 3 A. No.  
19:25:21 4 Q. Okay. So you'd have to physically cou --  
19:25:26 5 you'd have to physically take a Bair Hugger blanket  
19:25:28 6 and count how many holes to get the correct velocity  
19:25:31 7 for that particular blanket; correct?  
19:25:36 8 A. If you want to know the jet velocity coming  
19:25:39 9 out of the Bair Hugger then that is certainly one way.  
19:25:42 10 That's how I would do it.  
19:25:43 11 Q. Okay. Do you agree with the equation of 1.2  
19:25:55 12 with respect to the exit air temperature? The  $m_{in}$ ,  $h$   
19:26:15 13 in?  
19:26:15 14 A. I have no argument about --  
19:26:17 15 I have no disagreement with that equation.  
19:26:20 16 Q. What about with the equation below it with  
19:26:22 17 the  $h_{in}$  equals  $h_{exit}$  plus  $q_{body}$ , divided by  $m$ ?  
19:26:32 18 A. I have no disagreement with that equation.  
19:26:35 19 Q. Okay. So basically on those two equations  
19:26:38 20 you would agree with me that Elghobashi understands  
19:26:40 21 the basic laws of physics; correct?  
19:26:44 22 MR. GOSS: Object to form. I also think in  
19:26:47 23 redirect he made clear what his criticisms are. Now  
19:26:50 24 you're asking him beyond -- questions beyond that.  
19:26:53 25 If you can answer the question, you may.

19:26:55 1 A. Those two equations are the first law of  
19:26:58 2 thermodynamics, which governs energy conservation. I  
19:27:02 3 believe he has written those correctly.  
19:27:05 4 Q. I mean, but you stated in your report that  
19:27:08 5 he didn't understand the basic laws of physics. Well  
19:27:11 6 with respect to these equations do they indicate or  
19:27:16 7 not indicate that he knows the basic laws of physics?  
19:27:16 8 MR. GOSS: Objection to form. This is  
19:27:18 9 becoming counterproductive.  
19:27:19 10 I don't think you have to answer that. I  
19:27:21 11 think you already have.  
19:27:21 12 Q. Did you put in --  
19:27:21 13 MR. GOSS: And you said --  
19:27:22 14 Q. Did you put in your report that Elghobashi  
19:27:25 15 doesn't understand the basic laws of physics?  
19:27:27 16 A. I may have, and I believe he --  
19:27:29 17 I think you're confusing two things. I --  
19:27:32 18 What we're talking about here is a simple  
19:27:35 19 conservation-of-energy equation which I think he's  
19:27:37 20 written correctly, but that -- my arguments in his  
19:27:41 21 expert report go beyond a simple  
19:27:44 22 conservation-of-energy equation.  
19:27:46 23 Q. Okay. So you agree with me here that except  
19:27:49 24 for the one equation that you think you do different,  
19:27:52 25 which is the velocity -- the velocity of the air

1 coming out of the Bair Hugger, that all the other  
2 equations he used to calculate whatever he was  
3 calculating are correct?

4 A. Well I would argue the entire premise of his  
5 calculation is incorrect.

6 Q. Assuming Figure 3 is correct. The equations  
7 are correct. You're not disagreeing with the  
8 equations that he used.

9 MR. GOSS: Objection, mischaracterizes his  
10 testimony with respect to one of the equations.

11 A. I think equation 4 is incorrect.

12 Q. "Incorrect"?

13 A. Right.

14 Q. Okay.

15 A. I think he's used the wrong value of the  
16 convective coefficient.

17 Q. Well forget about the values used. I'm  
18 talking about the actual mathematical equation.

19 A. Actually he's got another maybe more serious  
20 error. In equation 3 he has the heat transfer to the  
21 body and he's got an "h" value times an area of the  
22 blanket surface. That's not correct. That should be  
23 the area of the body. So he's got the wrong area --

24 Q. Okay.

25 A. -- in equation 3.

19:29:12 1 I did not look up his enthalpy values, so I  
19:29:16 2 can't comment on whether they're correct or not.

19:29:25 3 Q. Okay.

19:29:25 4 (Interruption by the reporter.)

19:29:35 5 Q. Do you believe it is professional to call a  
19:29:39 6 professor or a scientist in the community that has  
19:29:42 7 been working 30 to 40 years doing engineering research  
19:29:46 8 and has published probably more than you, that that  
19:29:49 9 person doesn't understand the basic laws of physics?

19:29:52 10 MR. GOSS: All right. You had the  
19:29:53 11 opportunity to ask that question during seven hours  
19:29:55 12 of direct exam. This does not relate to my redirect.

19:30:01 13 MR. ASSAAD: It goes to him doing these  
19:30:03 14 calculations and criticizing his calculations.

19:30:06 15 MR. GOSS: Okay. I'm going to object to  
19:30:10 16 form on multiple grounds.

17 MR. ASSAAD: That's fine.

19:30:13 18 MR. GOSS: If you understand the question,  
19:30:14 19 then you can provide an answer.

19:30:16 20 A. I -- I'm not sure he has published more than  
19:30:19 21 me, but that's immaterial.

19:30:22 22 I think he has made some serious errors. I  
19:30:27 23 think he does not -- did not account for the buoyancy  
19:30:30 24 of the air in the OR, and I think that's a serious  
19:30:35 25 error. And so critici -- Look, scientists criticize

19:30:39 1 each other all the time.

19:31:01 2 Q. Would you expect someone such as your  
19:31:04 3 professor, Dr. Sparrow, to criticize someone of the  
19:31:08 4 stature of Elghobashi the way you did by saying he  
19:31:11 5 doesn't know the basic laws of physics?

19:31:13 6 MR. GOSS: Same objection. I'm also going  
19:31:16 7 to object that this doesn't have anything to do with  
19:31:17 8 the actual scientific opinions rendered in his report  
19:31:20 9 or the scientific issues subject to expert testimony  
19:31:22 10 in this case. I also think it was asked and  
19:31:25 11 answered.

19:31:28 12 MR. ASSAAD: What Dr. Sparrow would do?

19:31:30 13 MR. GOSS: All right. You can answer if  
19:31:31 14 you have an understanding of what Dr. Sparrow thinks  
19:31:35 15 and what he would do.

19:31:36 16 A. I don't know what Dr. Sparrow would do.

19:31:39 17 MR. ASSAAD: Well first of all I'm going to  
19:31:41 18 object to his -- any of his opinions that he gives  
19:31:45 19 outside his expert report as rebuttal under Rule 16  
19:31:49 20 and Rule 26 and the Court's PTO order that governs  
19:31:55 21 discovery in this case. This is untimely, especially  
19:31:58 22 with some of the documents that he had in his  
19:32:00 23 possession. I think he had everything in his  
19:32:04 24 possession prior to the deposition of Dr. Elghobashi.

19:32:09 25 Furthermore, these are new opinions that

19:32:11       1 the court has specifically refused and that the  
19:32:15       2 defense had a time to offer rebuttal. Well the Court  
19:32:19       3 definitely has refused surrebuttal. The expert  
19:32:22       4 time -- deadline to provide rebuttal opinions was  
19:32:25       5 June 2nd, and this should have been disclosed prior  
19:32:27       6 to then.

19:32:29       7                   MR. GOSS: And we will stipulate that Dr.  
19:32:31       8 Elghobashi's supplemental report is untimely.

19:32:38       9                   Subject to that, I disagree with what you said,  
10                10 --

11               11                  MR. ASSAAD: I haven't --

19:32:40       12                  MR. GOSS: -- respectfully.

19:32:41       13                  MR. ASSAAD: I haven't finished yet.

19:32:43       14                  MR. GOSS: You may finish. You may finish.

19:32:46       15                  MR. ASSAAD: And just for the record, this

19:32:47       16                  is not a supplemental report, this was added to his

19:32:50       17                  errata sheet in response to a question.

19:32:52       18                  MR. GOSS: You call it what you will.

19:32:58       19                  MR. ASSAAD: Okay. I lost my track or

19:33:01       20                  line, Peter. It's been a long day.

19:33:03       21                  Anyway, we're just going to object, a

19:33:05       22                  formal objection, and we're going to leave this

19:33:07       23                  deposition open for me to seek more documents

19:33:11       24                  possibly, and files that were clearly not produced

19:33:14       25                  today that were clearly in the possession of Dr.

1 Abraham and may have been in the possession of 3M,  
2 and we will address the other issues -- these issues  
3 with the court.

4 MR. GOSS: And I'll just state that we  
5 believe we have complied, but we understand your  
6 position.

7 MR. ASSAAD: That's it.

8 MR. GOSS: I don't have any further  
9 questions.

10 THE REPORTER: Off the record.

11 (Deposition adjourned at 7:33 p.m.)

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1 C E R T I F I C A T E

2 I, Debby J. Campeau, hereby certify that I  
3 am qualified as a verbatim shorthand reporter; that I  
4 took in stenographic shorthand the testimony of JOHN  
5 P. ABRAHAM, Ph.D. at the time and place aforesaid;  
6 and that the foregoing transcript consisting of 394  
7 pages is a true and correct, full and complete  
8 transcription of said shorthand notes, to the best of  
9 my ability.

10 Dated at Lino Lakes, Minnesota, this 24th  
11 day of July, 2017.

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15 DEBBY J. CAMPEAU

16 Notary Public

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1 S I G N A T U R E P A G E

2 I, JOHN P. ABRAHAM, Ph.D., the deponent, hereby  
3 certify that I have read the foregoing transcript,  
4 consisting of 394 pages, and that said transcript is  
5 a true and correct, full and complete transcription  
6 of my deposition, except per the attached  
7 corrections, if any.

8 PAGE LINE CHANGE/REASON FOR CHANGE

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20 Date Signature of Witness

21

22 WITNESS MY HAND AND SEAL this \_\_\_\_\_

23 day of \_\_\_\_\_, 2017.

24

25 (DJC) \_\_\_\_\_